INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

CHICAGO, ILLINOIS 60616

GAS ABSTRACTS INDEX

VOLUME 21 1965

AFFILIATED WITH

ILLINOIS INSTITUTE OF TECHNOLOGY

AUTHOR INDEX

A

Abernathy, J. W. 266
Abernethy, R. F. 199
Adams, D. F. 120
Adams, E. 429
Adams, L. 269
Adams, R. R. 188
Adamson, A. W. 306
Adcock, J. B. 381
Adler, R. J. 34
Agarwal, J. C. 412
Ainsworth, B. 98
Aker, J. E. 265
Akimoto, H. 380
Akin, C. M. 424
Albright, L. F. 68, 265
Alexander, E. G. 220
Alexandrov, A. V. 135
Alford, H. R. 94
Allen, J. B. 404
Allen, J. G. 212
Allen, J. W. 359
Allinger, N. L. 237
Almqvist, G. 464
Alperstein, M. 304
Alumbaugh, R. L. 376
Amalric, P. 68
Anders, G. 349
Andersen, H. T. 80
Anderson, C. R. 462
Anderson, D. A. 34
Anderson, J. H. 93, 101
Anderson, J. H., Jr. 93
Anderson, L. E. 215
Anderson, M. L. 277
Anderson, O. 12
Anderson, R. B. 103, 325
Andreen, B. H. 251
Andresen, G. E. 55
Andrew, S. P. S. 223
Andrews, J. M. 32
Angelo, N. B. 297
Angelone, J. J. 29
Angerhofer, A. W. 445
Anhorn, V. J. 302
Anney, F. W. 82
Anton, M. 362
Archibald, C. B. 100
Archibald, R. G. 6
Arghiropoulos, B. M. 22
Ariet, M. 341
Armstrong, F. E. 394
Armstrong, T. A. 5, 14 210, 249, 257
Arpaci, V. S. 158
Arps, J. J. 430
Arthur, C. E. 394
Ashby, J. H. 235
Ashby, P. J. 231
Ashford, D. A. 356
Ashley, B. E. 458
Ashworth, T. 216
Asselin, G. F. 184
Astarita, G. 236
Atkins, R. M. 268
Atwood, L. 336, 374
Aune, R. R. 215
Ausloos, P. 105
Austin, L. G. 341
Ayscough, P. B. 220

B

Babcock, R. S. 412
Babinsky, E. E. 28
Baca, D. E. 174
Bachman, W. A. 126, 168, 349
Bacon, F. T. 93, 393
Badgerow, H. L. 49
Badre, R. 271
Baker, B. S. 468
Baker, M. L. 373
Baker, W. R. 33
Baldus, H. 14
Balestrieri, S. 200, 235
Ballard, D. 251
Ballman, T. L. 108
Banfield, R. H. 196
Barber, H. W. 285
Barber, W. A. 350
Barbour, W. M. 302
Barkow, A. G. 155, 198, 253
Baron, T. 121
Bartell, L. S. 120, 237
Bartlit, J. R. 380
Barton, K. 35
Basmadjian, D. 272
Bata, G. L. 406
Bateman, P. L. G. 165
Bates, Jr., R. E. 130
Bates, T. P. 398
Batey, E. F. 60
Baucom, R. M. 198
Bauer, S. H. 205, 445
Baum, V. 350
Baumgartner, F. N. 5
Bayer, E. C. 226, 456
Beals, D. L. 208
Beals, H. T. 25
Bean, D. W. 253
Bean, H. P. 441
Becker, R. 102
Beckman, J. H. 100
Beebe, R. G. 262
Beeson, C. M. 353, 439
Begley, L. A. 30
Behrens, C. W. 225
Bell, F. 407
Bell, R. L. 179
Bell, S. A. 67
Bell, W. T. 281
Bellemans, A. 273
Belles, F. E. 384
Belliveau, P. H. 136
Belstering, C. A. 338
Benson, N. M. 358
Benson, S. W. 382
Benton, M. H. 372, 402
Benton, R. P. 430
Berard, D. J. 16, 100
Bercher, J. W. J. 201
Bergendoff, R. C. 358
Berger, C. V. 450
Bergman, H. W. 217
Bergman, R. K. 106
Berguson, H. E. 177
Berkin, J. P. 392
Berkowitz, R. 347
Berlie, E. M. 173
Bernas, A. P. 326
Berne, B. 308
Bernheim, R. A. 160
Bernstein, H. 36
Bernstein, R. B. 124
Berta, R. J. 100
Bertling, V. H. 219
Beuther, H. 183, 220
Bevans, R. S. 295
Bezus, A. G. 120
Bible, A. 393
Bichard, J. A. 54 (2)
Bickel, H. J. 241
Bieger, F. 140
Bienstock, D. 182, 285, 400
Binder, H. 159
Bingham, M. G. 56
Bird, D. B. 232, 269, 462
Bird, P. G. 334
Bird, R. J. 235
Birge, G. W. 181
Birkett, J. D. 308
Bischoff, K. B. 41, 321
Bishop, J. 177
Black, I. A. 322
Black, W. A. 465
Blackmer, R. H. 245
Bladeren, J. V. 300
Blaicher, R. D. 130
Blazeck, F. 286
Bleakley, W. B. 56, 171
Bleakley, W. B. 212
Bliss, H. 380
Blocker, N. K. 203
Blumberg, H. S. 301
Blunck, R. M. 310
Boden, W. 233
Bodle, W. W. 440
Bodman, S. W. 40
Boebinger, R. W. 286
Boggs, R. N. 71
Bogoliubov, I. S. 412
Bohm, A. 142
Boies, D. B. 9
Bokros, J. C. 341
Boldu, M. J. 338
Boley, C. C. 182
Boley, D. W. 438
Bolton, A. P. 258
Bomberger, D. R. 81
Bond, G. C. 219
Bonner, J. A. 366
Boon, J. P. 239
Borelli, F. 144
Borgan, R. L. 398
Borkowski, B. 134
Boubel, R. W. 369
Bourn, B. 185
Bowen, H. M. 176
Bower, G. R. 459
Bowler-Reed, J. 154
Bowman, C. H. 468
Bowman, C. R. 87
Bowman, G. 277
Box, G. E. P. 123
Boyd, W. H. 296
Boyen, J. L. 247, 381, 414
Bozeman, H. C. 15, 60, 175, 259
Brace, R. L. 96
Bradley, J. W. 391
Bradley, W. E. 221
Bradow, R. L. 304
Brancis, J. C. 373
Brandon, D. H. 3
Brandt, H. 399
Branson, W. R. 276
Braski, D. N. 82, 198
Brauer, E. B. 340
Braun, R. 326
Braun, W. H. 467
Brauweiler, J. R. 277
Bray, B. G. 394
Bray, G. A. 19
Brazelton, W. T. 40, 238
Breck, D. W. 24, 355
Bresler, S. A. 289
Brian, L. T. 40
Brief, R. S. 293, 422
Briggs, D. E. 297
Brillaud, A. R. 394
Brocoff, J. 14
Broder, A. 77
Brodlin, W. 66
Brogan, T. R. 316
Brooks, K. W. 2, 45, 65, 97, 105, 116, 324
Brown, B. 333
Brown, G. H. 71
Brown, K. M. 355
Brown, R. 314
Brown, R. A. S. 424 (2)
Brown, S. S. 82
Bruce, C. J. 71
Bruce, R. G. 32
Brundage, H. T. 389
Bruns, J. R. 159
Buividas, L. J. 222
Bukacek, R. F. 321, 387
Bulgakova, T. I. 148
Bump, D. D. 128
Burchard, V. H. J. 93
Burgar, J. F. 253
Burger, J. A. 152
Burgwald, G. M. 77
Burhorn, F. 53
Burke, D. P. 405
Burke, M. D. 8
Burkel, R. 197
Burket, P. V. 321
Burlingame, M. V. 138
Burnett, D. 204
Burrow, D. 70

Buscemi, V. P. 188
Bushnell, V. E. 371
Busse, C. A. 37
Butler, D. S. 467
Butler, R. M. 54
Buyuktur, A. R. 41

C

Cain, W. M. 301
Caldwell, B. J. 272
Caldwell, H. L. 396
Caldwell, J. H. 77, 298
Calva, J. B. 97
Calvert, S. 468
Cameron, R. W. N. 463
Campbell, F. A. 57
Campbell, J. C. 149
Campbell, R. A. 221
Campbell, T. R. 359
Campbell, W. C. 11
Caplan, S. R. 392, 433
Cappelletti, C. M. 37
Caraway, W. H. 354
Carberry, J. J. 22
Carden, S. N. 465
Carey, J. J. 117
Carlson, W. M. 430
Carlton, R. D. 418
Caroff, J. 271
Caron, R. 37
Carpenter, B. H. 299
Carr, M. D. 87
Carter, J. W. 24
Casassa, E. F. 43
Castor, C. R. 355
Ceram, A. I. 449
Chambers, P. 291, 295, 442
Chambers, R. L. 167
Champagnat, A. 350
Chang, A. 39
Chapman, D. A. 231
Chapman, H. E. 374
Chave, C. T. 316
Chen, W. T. 198
Cheung, H. 43
Chiche, P. 139
Chinnockm, H. J. 92
Chironis, N. 28
Chisholm, D. 340
Christ, W. 336
Christensen, C. 278
Christensen, J. J. 270
Christiansen, A. 330
Churchill, S. W. 468
Ciocca, G. 364
Ciocoiu, P. 258
Claes, P. 238
Clancia, J. 336
Clancy, T. M. 157
Clarine, N. L. 193
Clark, J. A. 158, 468
Clark, M. A. 70
Clark, M. B. 279
Clark, R. O. 155
Clark, W. W. 20, 148, 313, 430
Clarke, J. F. 239
Clay, P. E. 419 (2), 459
Claywell, J. W. 109
Clegg, B. G. H. 365
Clerk, J. 102
Clossmann, P. J. 157
Cluter, D. W. 202
Cobb, J. W. 376
Cockerham, R. G. 139, 364
Coffey, C. D. 30
Cohen, E. G. D. 274
Coleman, H. J. 320
Collins, T. B. 441
Colombo, U. 211
Colon, F. J. 140
Comyn, R. H. 341
Confer, R. G. 422
Connell, H. 370
Connell, J. T. 299
Conneran, J. F. 213
Considine, D. M. 268
Conway, L. F. 263
Conzales, D. J. 227
Conzemius, R. J. 155
Cook, I. P. 86
Cook, P. A. C. 258
Cook, W. H. 272
Cookson, R. A. 199
Coomes, J. 59
Cooper, A. 229
Cooper, A. R. 127
Cooper, C. M. 83
Copenhaver, W. G. 125
Corbell, I. T. 251
Cornely, K. W. 264
Corobow, P. 414
Corper, M. 344
Coryell, R. L. 292
Constantino, C. J. 159
Cotton, W. L. 10
Cottrell, T. L. 384
Coudeville, J. 134
Coulman, G. A. 34
Coveney, J. W. 248
Cowie, D. 314
Cowley, M. D. 267
Craig, R. G. 324
Cramarossa, F. 305
Crane, R. E. 413
Craske, A. G. S. 172
Crawford, C. L. 105
Crawford, R. F. 241, 310, 343, 385
Crennell, J. T. 231
Crippen, R. C. 119
Crockett, R. M. 359
Crosser, O. K. 363
Crowe, K. J. 197
Crownover, A. N. 468
Croysdale, L. G. 51
Cruickshank, A. J. B. 160
Cruise, D. R. 38
Cryor, R. E. 366
Csathy, D. 7
Cullinan, H. T. Jr. 305
Cullom, R. R. 381
Culmann, G. 421
Cummings, W. G. 410 (3)
Curtis, H. A. 455
Curtiss, C. F. 124
Cutler, A. J. B. 204
Cutress, J. O. 85, 182
Czoch, A. 184

D

Dailey, R. F. 322
Dale, J. 87
Daltry, J. H. 149
Dalzell, C. J. 127
Damerham, R. L. H. 11
Danatos, S. 34, 271
Dancy, F. E. 376
D'Annessa, A. T. 217
Darby, R. 245
Dardin, V. J. Jr. 68
Darland, W. G. 279
Darms, D. A. 460
Dart, D. M. 371
Das Gupta, S. K. 405
Dassau, W. J. 34
Dastur, S. P. 273
Davidson, R. L. 374
Davis, B. W. 38
Davis, G. R. 59
Davis, J. A. 57, 170, 207, 319
Davis, K. 267
Davison, J. L. 182
Davison, J. W. 102
Day, R. 215
Deal, C. H. Jr. 58
Dean, D. E. 384
Dean, R. D. 297
Dearden, J. 314
Deaton, W. M. 379
DeBoer, J. H. 305
DeCarlo, V. J. 425
DeCicco, R. W. 213
Decker, D. L. 65
DeCorso, S. M. 425
DeGrazio, R. P. 271
Deinken, H. P. 41
Deissler, R. G. 424
DeLaCastro, J. M. 277
DeLaCour, J. 284
Delatour, R. 242
DeLury, J. 101
Dempsey, J. R. 426
Demski, R. J. 182
Dengler, H. P. 53, 316
Denham, D. W. 186
Dent, F. J. 15, 141, 257, 364, 451
Denzel, J. 190
DePugh, D. 61, 62, 358, 400
Derr, E. L. 58
Derwish, G. A. W. 42, 203
Desai, K. P. 397
DeSilva, F. A. M. 317
Deutsch, K. 303
DeVilleneuve, P. G. 330
Devoe, W. F. 127
DeVoogd, J. G. 4
DeVos, F. J. 154
Dew, J. N. 394
DeWerth, D. W. 368 (3)
DeWinton, C. J. P. 106, 185, 326, 452
DeWitt, R. B. 10
Dexter, R. W. 120
Diamant, R. M. E. 299
Dick, W. 451
Didier, M. 419
Diebeler, V. H. 383
Diebold, J. 319
Diekmann, E. 138
Diener, B. 144
Dietrick, H. J. 93
Dillion, E. L. 5, 346
Dillon, C. P. 269
Dinescu, A. 258
Dinescu, R. 258
Dmuchovsky, B. 423
Dobe, H. D. 45
Dobransky, P. 364
Dodds, H. L. Jr. 321
Doelp, L. C. 324
Doherty, P. R. 322
Doizy, H. 262
Dollmeyer, C. H. 266
Domsky, I. L. 235
Dorfman, J. R. 274
Dotterweich, F. H. 193
Dorsett, H. G. Jr. 127
Dougherty, J. E. 41
Douglas, B. C. 113
Douglas, P. W. 29
Douloff, A. A. 251
Dowds, J. P. 397
Draper, L. 283
Dravnieks, A. 9
Dreving, V. P. 120
Drewry, H. S. 333
Drisko, R. W. 376
Dropkin, D. 122
Drum, J. R. 16
Drummond, W. 327
Duckworth, G. L. 440
Duckworth, J. C. 7
Duddy, J. C. 165, 279
Dudek, M. 421
Duff, G. M. S. 422
Duffy, A. R. 321, 361
Duffy, R. E. 88
Duhamel, R. F. 337
Dumbrell, R. 352, 353
Duncan, L. Jr. 431
Dunham, P. G. 199
Dunn, C. L. 171
Dunn, S. F. 52
Dunnavant, W. R. 154
Dupuis, J. L. 275
Durif, S. 139
Durmish'yan, A. G. 58
Dutta, B. K. 356
Dwyer, F. G. 58
Dyer, A. F. 127
Dyer, G. R. 107
Dykstra, D. I. 316
Dyne, P. J. 238
Dyste, N. L. 334

E

Eakin, J. L. 354
Eaton, B. A. 284
Eaton, L. D. 422
Eck, J. C. 25
Eckard, W. E. 354
Eckert, C. A. 466
Eckhouse, J. G. 257, 290
Eden, C. 220
Edgerton, C. D. Jr. 167
Edmisten, E. D. 464

Edmister, W. C. 158, 380, 467
Edmondson, H. 29
Edstrom, J. O. 82
Edwards, J. H. 250
Edwards, J. V. 412
Egbert, C. W. 108
Egger, C. T. 120
Eiber, R. J. 321
Eisenlohr, K. H. 405
Eisenstadt, M. M. 84
Ekiner, O. 382, 423, 425, 469
Eklund, R. 74
Elgin, D. C. 406, 452
Ellend, V. H. G. 400
Ellington, R. T. 239, 321
Elliott, J. H. 449
Ellis, R. M. 8
Ellis, W. P. 80
Ells, J. W. 176
Elonka, S. 416
El Sahrigi, A. F. 43
Emmony, R. O. 97, 407
Engelbrecht, H. L. 97
Englander-Golden, P. 382
Enright, R. J. 47, 250, 429, 444
Erickson, G. J. 190
Erickson, R. A. 184
Ernst, M. H. 274
Esbrook, E. W. 147
Eschenroeder, A. Q. 37
Eschrich, J. 277
Eshghy, S. 158
Estep, J. W. 173
Estopinal, E. J. Jr., 103
Ettre, L. S. 271
Evans, C. W. 192
Evans, J. B. 304
Evans, R. K. 417
Evans, S. R. 359
Everett, D. H. 86, 160, 384
Ewing, B. 279
Eyring, H. 303

F

Fagnant, J. A. 219
Fair, J. R. 297
Fairman, L. 318
Falkenbach, G. J. 418
Fallon, P. 11
Fan, D. N. 86
Fan, P. H. 95
Fanning, R. J. 32
Farkas, G. B. 63
Farrar, G. L. 460
Fast, C. R. 439
Fay, P. S. 315, 349
Fegley, K. A. 86
Fehsenfeld, G. D. 341
Feinman, J. 326
Feldkirchner, H. L. 222
Feldmann, H. 221
Feldstein, M. 200
Felstein, M. 235
Fender, J. E. 429
Feng, K. K. 338
Ferraro, J. P. 464
Ferree, R. E. 264
Ferrell, J. K. 40
Ferron, J. R. 423
Fetkoyich, M. J. 159
Field, F. H. 38, 341
Field, J. H. 182, 285, 400
Figler, R. G. 125
Filstead, C. G., Jr. 288, 403
Finch, G. N. 28
Fisher, E. R. 377
Fitch, A. G. 441
Fitton, G. 365
Fitzgerald, D. D. 249, 398
Fitzgerald, F. 158
Fitzgerald, H. H. 138
Fitzgerald, III, J. H. 82
Flumara, A. 364
Flath, R. A. 271
Fleishmaker, E. G. 143
Flittle, W. J. 344
Flumerfelt, G. C. 338
Foch, P. 181
Fogarty, D. J. 294
Follett, D. H. 70
Fontaine-Limbourg, M. C. 239
Ford, E. 146, 207, 457
Ford, P. E. 176
Forney, A. J. 182
Forst, W. 338
Forster, F. 362
Fortescue, P. 209
Foster, J. R. 185
Foster-Pegg, R. W. 295
Fouchard, P. 262
Fowkes, F. M. 37
Fox, J. M. 326
France, J. 40
Frank, J. R. 398
Frankenberg, T. T. 320
Franklin, J. L. 38
Fraser, G. M. 314
Frear, M. E. 184
Freche, J. C. 422
Freck, D. V. 325
Freedman, R. W. 303
Freedman, S. D. 89
Freerks, M. C. 423
Freifelder, M. 183
Freitas, E. R. 171
French, H. 209, 280
French, M. J. 348, 360
Freud, V. M. 119
Fris, J. P. 172
Frisby, D. L. 96
Frisch, H. L. 308
Frisch, M. A. 199
Frischmuth, R. W., Jr. 238
Fritts, C. T. 302
Fromm, J. E. 121
Fryar, J. R. 284
Frye, E. O. 10
Fujita, R. K. 355
Fuks, S. 273
Fuller, E. N. 302
Fuller, M. E. 272
Fullman, R. L. 349
Fulton, J. W. 363
Funk, E. R. 233
Futrell, J. H. 123 (2), 203, 204

G

Gaikhorst, G. 136
Gallaher, P. E. 407
Gallant, H. 434
Gallant, R. W. 306, 340
Galley, J. 298
Galli, A. 42, 203
Galstaun, L. S. 432
Gambrill, C. M. 199
Gandini, A. 338
Ganss, O. 437
Gant, P. L. 36
Garbalinskii, V. A. 272
Gardiner, W. C., Jr. 42
Gardner, F. J. 283
Gardner, G. L. 233
Gareis, P. J. 96, 217
Garfinkle, M. 382
Garmon, J. J. 302
Garrad, C. 346
Garrett, L. W., Jr. 68
Gaskell, D. R. 196
Gaskell, T. F. 398
Gasparovic, N. 455
Gates, G. L. 354
Gauthier, C. J. 207
Gayle, J. B. 201
Geddes, J. H. 440
Gerhardt, H. M. 236
Geld, I. 375
Gendre, P. 386
Genthe, W. K. 77
George, J. H. B. 308
Gerber, N. H. 450
Gerbitz, E. A. 372
Gerhart, H. L. 337
Gernand, M. O. 303
Geske, L. D. 80
Ghaly, E. L. 10
Giardini-Guidoni, A. 42, 203
Gibson, J. A. 123
Gidaspow, D. 468
Giddings, J. C. 84, 88, 302, 303
Gignier, J. P. 141
Gilbertson, W. F. 377
Giles, B. L. 185
Gill, J. H. 111
Gill, J. M. 264
Gilmer, H. B. 303
Gilmour, C. H. 297
Gimse, D. R. 214
Ginsberg, H. H. 67
Girdhar, H. L. 200
Githens, R. E. 297
Giusti, P. 338
Glander, H. 293
Glaser, P. E. 322
Glasgow, J. S. 154
Glassman, A. J. 52, 384
Glen, C. G. 457
Glogoczowski, J. 437
Gluntz, D. M. 435
Gocze, E. M. 25
Godbold, F. S. 171, 211
Godet, G. 436
Godfrey, H. L. 114
Goeschell, H. 53
Golden, C. C. 119
Golden, D. M. 382
Goldfarb, S. R. 373
Goldfiner, P. 423
Goldner, L. 411
Gomez, M. 182, 201
Gonzalez, R. J. 311
Gooderham, W. J. 218, 421
Goodman, J. B. 182
Goodman, R. C. 277
Goodrich, J. 464
Gorbunov, G. V. 83
Gorin, E. 103, 290, 325, 363
Gormsen, B. 58
Gorring, R. L. 220
Gorshkov, V. A. 143
Goss, C. L. 71
Goss, J. M. 286
Gossett, J. W. 470
Gothard, F. 258
Gould, L. A. 273
Govier, G. W. 121, 424
Gowen, R. A. 273
Grabke, H. J. 382
Grabowsky, W. R. 51
Graham, C. B. 55
Graiff, L. B. 227
Grant, A. F. 24, 104
Gray, K. E. 283
Greenhill, E. L. 78
Gregg, S. J. 340
Grens, E. A. 36
Griffing, G. W. 41
Griffiths, J. C. 295
Griffiths, R. T. 459
Grimes, P. G. 94
Grimm, W. 190
Grobhans, W. 405
Groenweghe, L. C. D. 38
Grohs, H. 464
Grossmann, U. C. 361, 440
Grow, G. C., Jr. 403
Grumberg, J. 379
Grumbkow, P. V. 246
Grumer, J. 294
Gruneberg, G. 315
Grunewald, R. L. 294
Gubbins, K. E. 465
Guccione, E. 140, 222
Guggenheim, E. A. 383
Guilhem, J. 63
Guillerm, R. 271
Gulbransen, E. A. 197
Gumley, P. 40
Guntermann, W. 409
Guty, V. 156

H

Haag, F. 113
Haalman, A. 229
Habermehl, R. 64
Hacker, P. T. 154
Haensel, V. 289
Hagenbach, G. F. 217, 360
Hagle, M. G. 440
Hainesm, W. E. 85
Halbach, K. 33
Hale, D. 192, 408
Halepeska, B. F. 399
Hall, J. L. 384
Hall, W. K. 469
Hammar, W. 431
Hammon, S. 447

Hammond, G. L. 194
Hancock, R. A. 262
Hangebrauck, R. P. 293
Hanger, R. T. 228
Hanink, K. K. 152
Hannah, R. R. 399
Hansen, L. D. 270
Hanson, H. R. 81
Hanson, M. P. 179
Hardcastle, R. 458
Harllee, F. N. 383
Harlow, F. H. 121
Harmon, J. F. 306
Harocopos, B. 465
Harper, J. C. 43
Harris, E. R. 97
Harris, F. N. 398
Harris, J. A. 71, 187
Harris, J. O. 466
Harris, L. S. 300
Harris, M. E. 294
Harrison, H. L. 144
Harrison, P. R. 118
Hart, H. R. 459
Hartley, P. F. 254
Harbey, F. 449
Haseltine, N. G. 439
Hasha, B. J. 175
Hata, G. 102
Hathaway, P. L., Jr. 26
Haueter, R. L. 10
Hauk, V. 354
Haumann, W. 100
Hauptmann, E. G. 157
Hausler, L. M. 10
Hawk, C. O. 67, 364
Hawley, J. 115
Haworth, D. T. 279
Hawtin, P. 123
Hayes, D. H. 454
Hazelby, D. 302
Hazell, J. E. 406
Healy, C. T. 166
Heath, C. C. 99
Hebden, D. 256
Hebert, F. E. 214
Hebert, M. R. 161
Hedberg, H. D. 13
Hederhorst, F. 374
Heidelberg, L. J. 447
Heimerl, G. J. 198
Heinemann, H. 223
Heinze, R. B. 263
Heinzelman, J. 31
Heitmann, G. 377
Hemmer, P. C. 88
Hemminger, C. E. 106
Henley, E. J. 134
Henneke, E. G. 95
Henry, F. L. 402
Henry, W. R. 335
Henshilwood, C. P. 365
Herb, R. G. 159
Heredy, L. A. 65
Herman, L. 379
Herridge, G. H. 391
Hertel, G. R. 202
Hesler, J. C. 77
Hess, R. A. 52 (2)
Hester, C. T. 398
Heymann, D. 155
Hibbard, R. R. 19
Hickel, R. O. 179
Hickle, W. G. 260
Hidaka, M. 110
Hiedl, H. 296
Hiemforth, C. W. 413
Higginbotham, H. K. 120
Hill, D. W. 84
Hill, E. S. 171
Hill, H. G. 228
Hill, L. C. 196
Hill, R. J. 42
Hillemanns, H. 354
Hillenbrand, L. J. 129
Hillman, J. J. 425
Hillsman, J. M. 355
Himmelblau, D. M. 41
Hind, J. A. 437
Hiniker, T. G. 55, 227
Hirschmann, W. R. 277
Hiteshue, R. W. 67, 364
Hobbs, M. 243, 390
Hodge, A. L. 412
Hodge, B. 244
Hoelscher, F. W. 335
Hoenig, S. A. 84
Hoff, N. J. 359, 360
Hogan, W. H. 18
Hogg, A. M. 124, 305
Hoggarth, M. L. 225
Holben, C. D. 101
Holdsworth, S. D. 300
Hole, H. D. 355
Hollax, E. 349
Holliday, D. V. 60
Hollowell, C. D. 237
Hollowell, G. T. 411
Holmgren, G. W. 136
Holroyd, R. A. 69
Holtom, H. T. 432
Hoof, R. G. 287
Hopkins, R. L. 320
Horner, F. W., Jr. 101
Horowitz, H. H. 349
Horsler, A. G. 256
Horton, R. C. 282
Hough, E. W. 340 (2)
Houlton, H. G. 87
Houseman, J. 339
Howard, J. R. 333
Howard, R. L. 280
Howard, R. M. 107
Howell, J. 319
Hoy, H. R. 256
Hoyle, N. 453
Hrapia, V. H. 421
Huber, F. 141
Hudson, H. K. 280
Huebler, J. 221 (3), 222
Hughes, R. V. 168
Hughes, T. W. 453
Hughson, R. V. 269
Hull, J. P. D., Jr. 396
Hull, R. J. 45
Hummell, J. D. 399
Humphrey, W. E. 318
Hunt, J. C. R. 237
Hunter, K. G. 123
Huntington, R. L. 328
Hurrell, R. A. 119
Hurter, W. 325
Hutchison, C. N. 230
Hutchison, K. 437
Hutchison, S. O. 317
Huybrechts, G. 423
Hylak, P. J. 69

I

Ihenfield, H. L. 110
Imam-Rahajoe, S. 124
Imhoff, D. H. 55
Inger, G. R. 39
Inghelbrecht, M. 145
Inman, R. M. 158
Inoue, T. 59
Irons, J. D. 109
Irwin, J. C. 307
Ives, M. B. 301
Izatt, R. M. 270

J

Jackson, G. 130
Jackson, R. G. 348
Jackson, S. P. 359
Jackson, W. O. 464
Jacobs, J. K. 299
Jacobs, M. B. 304
Jacoby, R. H. 284, 380
Jain, L. K. 236
James, G. R. 289
James, M. R. 88, 303
Janak, J. 199
Janke, W. 377
Jasinski, R. 128
Jasinski, R. J. 245
Jebens, R. H. 316
Jeffers, P. 445
Jeffrey, D. A. 53
Jensen, E. J. 347
Jewers, W. G. 312, 427
Jhaveri, J. 272
Jizba, Z. V. 11
Johanson, E. S. 288
Johnsen, R. H. 469
Johnson, A. I. 271
Johnson, D. 172
Johnson, G. R. A. 383
Johnson, H. R. 438
Johnson, J. H., Jr. 98
Johnson, K. E. 440
Johnson, M. F. L. 236
Johnson, P. H. 448
Johnson, W. J. 431
Johswich, F. 400
Jokela, W. V. 377
Jones, J. E. 360
Jones, P. W. 93
Jones, W. R. 410 (3)
Jonswold, C. R. 386
Jordan, F. X. 89
Jordan, R. C. 54
Jordan, V. A. 58
Joseph, J. 296, 318
Joshi, R. K. 342
Joyce, C. P. 296
Joyce, M. P. 328
Joyce, T. J. 409
Judah, M. A. 62, 357
Jung, M. 315
Jungemann, L. J. 71
Justus, C. K. 185
Juveland, A. C. 41
Juzi, Z. 75

K

Kaiser, H. R. 213
Kaminishi, G. I. 469
Kammermeyer, K. 320
Kan, Y. 362
Kane, G. P. 276
Kane, V. V. 87
Kapyshev, A. G. 65
Karim, G. A. 86
Karmen, A. 226
Karn, F. S. 103, 325
Karp, H. R. 271
Kasatkin, V. G. 33
Kassor, E. W. 285
Kastrop, J. E. 438
Katan, T. 36
Katell, S. 64, 400
Kaufman, A. N. 38
Kauzlarich, J. J. 159
Kawai, K. 170
Kawasaki, K. 43
Kaye, S. 334
Kaylor, F. B. 108
Kays, W. M. 40
Kchalatin, V. I. 135
Kebarle, P. 124, 305
Keck, J. 42
Kedem, O. 392
Kehat, E. 201, 459
Kehoe, T. J. 270
Keighery, F. L. 331
Keith, P. C. 21, 63, 449
Keller, C. 281
Keller, K. H. 229
Keller, R. A. 88
Kelley, R. 256
Kelly, E. J. 360
Kelly, G. L. A. 147
Kelly, M. E. 200
Kelly, P. 133
Kemnitzer, W. J. 167
Kendall, K. 33
Keng, E. Y. H. 468
Kennedy, F. K. 285
Kennedy, H. T. 468
Kennedy, R. E. 381
Kennedy, S. L. 133
Kenward, J. R. 259, 415
Keplinger, C. H. 132
Kerr, H. 439
Kerr, J. W. 242, 344, 389
Kerver, J. K. 81
Kerwin, P. T. 16
Kessock, O., Jr. 172
Kestin, J. 41
Keur, E. 155
Kielich, S. 272
Kies, J. A. 36
Kikkawa, M. 206
Kilham, J. K. 199
King, J. G. 142
King, R. Q. 324
Kinsman, F. E. 442
Kircher, J. F. 53
Kirk, M. C., Jr. 184
Kirk, W. B. 164
Kirkland, C. G. 379

Kiselev, A. V. 120
Kister, T. L. 95
Kivilis, D. A. 65
Klann, J. L. 16
Kleemann, H. 356
Klein, G. W. 69
Klima, S. J. 422
Klingman, C. L. 83
Klovan, J. E. 249
Knapp, S. R. 209
Kniebes, D. V. 321
Knight, C. E. 442
Knight, H. 118
Knights, I. A. 359
Knizner, J. E. 107
Knorre, V. G. 85
Knutson, C. F. 394
Kobayashi, R. 303
Koehler, H. 354
Koenecke, D. F. 462
Kofskey, M. G. 52
Kohler, J. W. L. 239
Kohling, A. 159
Kohloss, F. H. 108
Kohn, H. M. 369
Kohn, J. P. 236
Kokesh, F. P. 131
Kollar, F. 271
Komora, L. J. 368
Kondo, R. 222
Kopecky, K. R. 341
Koppe, R. K. 120
Koppel, L. B. 40
Korchynsky, M. 376
Kordesch, K. 349
Kordesch, K. V. 279
Korin, A. D. 63
Kornfield, J. A. 26, 99, 215, 357, 443
Kortier, W. E. 55
Koski, W. S. 202
Kostin, M. D. 423
Kothmann, R. E. 425
Koutsky, J. A. 34
Koutsoukos, E. P. 405
Kozlov, G. I. 85
Kozulin, N. A. 65
Krauss, M. 383
Kravtchenko, M. 172
Kraybill, H. 151
Kreydich, J. 269
Kridner, K. 48, 143 (2), 174 (2), 348, 357, 402, 441, 443
Kriebel, A. R. 87
Kritzer, R. W. 366
Kroencke, R. L. 251
Kronberger, H. 432
Krouse, H. R. 338
Krupp, H. 159
Kruzan, H. F. 409
Kubair, V. 381
Kubokawa, 380
Kuchitsu, K. 237
Kuck, C. H. 461
Kuerston, R. D. 285
Kulgein, 122
Kuloor, N. R. 381, 382, 425
Kulyamin, A. F. 65
Kunz, H. R. 315
Kunz, H. 421
Kuznetsov, I. A. 273
Kyle, B. G. 236

L

Lacey, J. A. 256
Lacksonen, J. W. 128
Lafferty, H. B. 400
Lahaye, P. G. 267
Lahiri, A. 405
Lahmann, E. 465
Lalos, G. T. 194
Lama, R. F. 341
Lamb, D. E. 423
Lambert, D. E. 248, 313
Lambert, E. E. 387
Landers, W. D. 182
Lanewala, M. A. 258
Lange, J. M. 107
Langnes, G. I. 353
Lapie, P. O. 315
Larsen, P. S. 468
Larson, J. G. 469
Larson, O. A. 220
Lashkevich, R. I. 83
Latham, B. F., Jr. 285
Latham, D. R. 85
Laube, H. L. 310
Lauck, F. 293
Lauver, M. R. 384
Lavery, B. J. 160
Lavin, R. E. 201
Lavine, I. 230
Lawson, A. M. 300
Lebedev, V. K. 83
Ledeen, H. 372
Lee, A. L. 239, 426
Legros, J. C. 239, 273
Leicht, H. 439
Leinbach, R. C., Jr. 337
Leisek, J. F. 281
Lennert, D. A. 308
Lenoir, J. M. 202
Leopold, W. R. 417
Lesco, D. J. 422
Lester, G. 419
Lester, J. 291
Letan, R. 459
Leung, P. K. 86
Levaggi, D. A. 235
Levine, H. B. 339
Levis, R. H. 357
Levy, S. 121, 340
Levy, S. I. 5
Lewis, J. B. 123
Lewis, R. D. 48, 60, 143, 174, 357, 358, 443
Lewis, R. E. 217
Li, J. C. M. 41
Li, N. N. 134
Lias, S. G. 105
Libby, H. T. 407, 408
Lichtenstein, I. 29
Lieberg, O. S. 265
Liebert, C. H. 19
Lien, A. P. 153
Light, R. J. 334
Lithous, D. A. 406
Lijinsky, W. 235
Lincoln, K. A. 37
Lindahl, H. A. 172
Lindenmann, P. F. 207
Linden, H. E. 105
Linderberg, J. 340
Linderstrom-Lang, C. U. 36
Lindgren, R. W. 359
Lindsly, R. R. 312
Lippens, B. C. 305
Liptak, L. C. 71
Little, J. G., Jr. 428
Littlefield, D. B. 351
Litvinchuk, M. D. 83
Liu, B. Y. H. 54
Livingston, V. 228
Ljungberg, L. 82
Lloyd-Ellis, W. 402
Lobb, O. J. 368
Lockwood, N. R. 278
Loeb, L. B. 307
Logan, A. G. 231
Logan, L. J. 169, 387
Logigan, V. S. 354
Logiudice, A. S. 223
Logwinuk, A. K. 324
Loison, R. 181
Lombard, D. B. 394
London, H. 371
Long, F. V. 117, 170
Long, R. B. 134
Lorentzen, G. 268
Lotz, W. A. 82
Love, F. H. 253, 356, 444
Loveberg, R. 37
Lovell, L. M. 183
Lu, B. C. Y. 341
Lubyen, W. L. 332
Lucas, T. A. 259, 415
Ludwig, M. 21
Lunak, T. E. 463
Lynch, J. F. 358
Lynch, J. H., Jr. 181
Lyshkow, N. A. 399

M

MacCormac, M. 257
MacDonald, C. G. 340
MacFarlane, C. H. 444
MacGregor, J. R. 353
MacKinnon, A. J. 298
McAleer, J. K. 260
McAlister, J. A. 468
McBride, R. B. 172
McCallion, J. 233
McCarty, M., Jr. 377
McCaslin, J. C. 243
McCleary, U., Jr. 379
McClure, G. M. 321
McCullough, H. 338
McCusker, P. A. 203 (2)
McDaniel, R. 72
McEvoy, J. E. 52, 363 (2)
McFarlan, A. I. 367
McGrath, I. A. 53
McGregor, A. 459
McKee, D. W. 182, 339
McKenzie, M. G. 196
McKetta, J. J. 467
McKinley, D. L. 172
McKinley, M. D. 382
McKnight, W. H. 375
McKoy, V. 202
McMahon, H. O. 18
McMullan, O. W. 331
McNeill, R. 190
McNesby, J. R. 203
McPherson, A. T. 395
McPherson, H. L. 312
McQuarrie, D. A. 339
McRee, D. I. 381
McTaggart, N. G. 36
Mack-Forlist, D. M. 51
Mackay, D. 383
Mackdanz, C. H. 463
Mackle, H. 199
Madell, J. T. 280
Maeder, P. F. 41
Mafrica, L. 289
Maher, J. B. 322, 361, 446
Mahoney, T. 309
Mair, J. 322, 361, 446
Major, C. J. 320
Malay, F. L. 316
Mallinson, J. H. 232
Malloy, J. B. 238
Malone, M. E. 408
Mamaev, V. 273
Mamedov, Yu. G. 58
Mandell, D. A. 180
Manning, C. R., Jr. 198
Mansfield, V. 103
Manuel, K. 267
Marchello, J. M. 158, 467
Marhem, R. V. 114
Markert, J. W. 225
Marks, R. H. 416
Marsden, D. G. H. 338
Marsden, S. S. 170
Marshall, W. E. 67
Marsham, T. N. 393
Martell, E. H. 173
Martens, G. 423
Martin, D. 212, 448
Martin, J., Jr. 376
Martin, M. 358
Martin, R. 241
Martino, R. L. 2, 346, 430
Marton, F. D. 261
Marvin, J. G. 424
Mary, A. J. 214
Masciantonio, P. X. 107
Mase, G. D. 439
Mason, D. M. 156
Mason, E. A. 273
Mason, R. E. A. 461
Masood, M. A. 219
Mass, M. A. 148
Massey, J. F. 351
Mather, W. B., Jr. 393
Mathias, R. J. 16
Mathur, G. P. 308
Matson, B. G. 399
Matula, D. W. 38
Mawhinney, M. H. 149
Maxey, C. L. 66
May, J. W. 364
Mayer, F. X. 451
Mayer, I. 451
Mayeran, W. A. 230 (2)
Mayhew, Y. R. 40
Mayo, W. 2
Mays, R. L. 258
Mazurowski, M. J. 349
Meaburn, M. 384
Meadows, P. 132

Meckler, G. 456
Medvedeva, V. D. 272
Meeker, J. E. 293
Meeks, J. C., Jr. 83
Mehra, V. S. 339
Meimarakis, G. 181
Meinhert, L. L. 87
Meinhold, T. F. 181
Meisels, G. G. 160, 203, 469
Meitzen, V. C. 159
Meitzner, G. 349
Melfi, L. T., Jr. 84
Melia, T. P. 39
Mellen, A. W. 254
Mellows, F. W. 384
Mengelkamp, R. A. 147
Metier, A. V. 232
Meyer, K. 377
Meyer, W. C. 55
Meyers, L. 423
Meyrignac, J. 366
Mezey, E. J. 418
Michael, P. 238
Michard, D. T. 114
Michard, J. 145
Michaus, J. P. 173
Michel, R. C. 318
Mickley, H. S. 273
Miesch, E. P. 468
Miller, E. F. 80
Miller, J. E. 75
Miller, J. S. 354
Miller, K. J. 337
Miller, L. A. 296
Miller, L. N. 354
Miller, R. 23, 405
Miller, R. B. 371
Miller, R. D. 119
Miller, W. D. 87
Millikan, R. C. 383
Mills, C. E. 451
Mills, G. A. 52
Mills, R. E. 330
Milner, M. J. 221, 256
Milton, R. M. 66, 355
Minea, I. 258
Miner, R. G. 371
Minor, W. R. 297
Mirza, A. 219
Mirzadzhanzade, A. Kh. 58
Mistrot, D. 443
Mistrot, D. J. 463
Mitalas, G. P. 454
Mitchell, N. L. 317
Mitra, J. R. 405
Moeller, K. G. F. 279
Moen, R. H. 435
Mohr, P. H. 96
Molinari, E. 305
Mon, T. R. 271
Monchick, L. 273
Monkman, F. C. 115
Monnin, C. F. 381
Monroe, J. M. 372
Montgomery, R. S. 65
Moore, C. B. 236
Moore, E. E. 214
Moore, K. L. 232, 269
Moore, P. L. 435, 436
Moore, R. V. 350
Moore, S. A. 419
Moore, W. H. 283
Moore, W. W. 439
Morecraft, D. W. 37
Morgal, P. W. 221
Morgan, E. 233
Morgan, E. R. 376
Morgan, J. H. 195
Morita, S. 59
Moritz, K. H. 103
Morris, R. L. 131
Morrison, J. A. 204
Morrison, W. E. 46
Morrow, W. E. 302
Mortimer, J. V. 36
Morton, G. 446
Moseley, F. 104
Moser, H. C. 204
Moser, J. F., Jr. 103
Moyal, M. 218, 386, 428
Mueller, H. E. 277
Mueller, T. 108
Mulcahy, M. F. R. 123
Muller, B. H. 306
Muller, K. 35
Munn, R. J. 86
Munson, M. S. B. 38, 341
Murdoch, R. 123
Murff, J. T. 438
Murphy, C. E. 70, 85
Murphy, P. L. 100
Murray, G. E. 57
Murray, J. D. 201
Murray, S. F. 417
Murrill, P. W. 306
Muskat, D. A. 326
Mustafa, A. 10
Myers, A. L. 305
Myers, P. S. 293
Myers, W. 343

N

Nabors, F. L. 439
Nager, M. 103
Nagy, J. 127
Nanda, A. C. 356
Nangea, A. G. 328
Narsimhan, G. 381
Nathan, C. C. 35 (2)
Naugle, B. W. 289
Nazarchuk, M. M. 424
Negra, J. S. 326
Neild, A. B. 95
Nelson, G. A. 81, 233
Nelson, J. K. B. 436
Nelson, L. W. 461
Nelson, W. L. 161
Nesbitt, J. D. 369
Nestor, J. R. 273
Neuman, S. 30
Neutworth, M. B. 65
Nevens, T. D. 105
Newfarmer, L. R. 346
Nicholls, J. H. 231
Nichols, E. S. 152
Nickel, O. 197
Nicol, A. A. 459
Niedergesass, G. 234
Niedrach, L. W. 8, 94, 393
Niedzwiecki, J. L. 332
Niedzwiecki, R. W. 295
Nielsen, K. L. 80
Nielson, I. 316
Nishioka, K. 362
Nobe, K. 405
Nodwell, R. A. 307
Nofrey, C. E. 216, 358
Nolte, C. B. 193, 267
Norem, S. D. 271
Norrell, G. P. 119
Norton, F. J. 339
Norton, J. F. 375, 462
Novack, M. E. 316
Novak, J. 199
Novick, M. 55
Noes, C. M. 304
Nunnikhoven, J. D. 337
Nuttall, J. E. 174

O

Oberhofer, A. W. 77
Obermiller, E. L. 303
Obi, K. 380
O'Brien, N. G. 38, 285
O'Connell, J. P. 43
Odier, R. 366
O'Donnell, J. P. 17, 18, 62, 99, 136, 175, 379
Ogle, F. T. 416
Ohrn, Y. 340
Okuno, I. 85
Olbregts, J. 423
Olmstead, L. M. 246
Olson, R. L. 372
Olson, W. G. 466
Olt, T. F. 67
Olyphant, M., Jr. 358
Opfell, J. B. 237
Oppenheim, I. 43
Orlofsky, S. 290
Orr, C., Jr. 468
Orr, W. R. 157
Orth, R. W. 232
Ortuglio, C. 289
Oryle, R. V. 236
Osborn, J. O. 120
Osborne, A. 86
Oshima, K. 178
Ostapenko, N. G. 83
Ostroff, A. G. 232
Ostroumov, G. A. 157
Oswin, H. G. 208
Otani, S. 380 (3)
Othmer, D. F. 140
Overbey, W. K., Jr. 438
Overstreet, L. T. 268
Owczarki, W. A. 337
Owens, W. D. 171
Oxley, J. H. 418

P

Padgett, J. 398
Padovani, C. 24, 182
Page, G. G. 466
Pakurar, T. A. 423
Palmer, J. D. 301 (2), 376
Panos, P. S. 409
Pansing, W. F. 238
Pantke, H. D. 67
Papadopoulos, M. N. 58
Parczewski, K. I. 295
Parker, H. A. 459
Parker, M. E. 152
Parker, W. D. 231
Parrish, F., Jr. 132
Parsons, W. J. 97
Paschal, E. A., Jr. 170
Pate, A. R., Jr. 213, 356
Patel, V. C. 467
Paterson, D. 104, 405
Paton, B. E. 83
Paul, M. A. 205
Pauliukonis, R. S. 446
Pavlak, C. J. 109
Paxson, B. N. 421
Peal, W. R. 276
Pecchioli, F. 364
Peet, N. P. 327
Pelton, D. H. 285
Pennington, B. F. 340
Percival, G. 139, 364
Pereira, A. N. G. 273
Perez-Palacio, R. 56
Perkins, A. J. 118
Perkins, P. J., Jr. 138
Peris, T. A. 270
Perman, R. 411
Perraud, M. 386
Perrine, E. G. 366
Perry, J. L. 137
Perry, S. G. 119
Persson, B. 41
Pesti, G. 184
Peters, F. M. 101
Peters, W. 219
Peterson, D. B. 203 (2)
Peterson, J. B., Jr. 381
Peterson, M. H. 375
Peterson, M. L. 228
Petrazhitskiy, G. B. 14
Petryschuk, W. F. 271
Petty, J. W. L. 360
Petz, J. I. 422
Pfeffer, R. 39
Pfeiffer, R. W. 68
Phinney, J. A. 92
Phillips, B. A. 262
Phillips, J. W. 397
Phillips, R. C. 45
Phillips, S. R. 137
Pichel, W. 70, 269
Pichler, H. 324
Pickering, E. W. 287, 321
Pickert, P. E. 258
Pidock, J. F. 136
Pierce, W. S. 447
Pigford, R. L. 121
Pinchak, A. C. 87
Pinder, P. C. 22
Pink, J. F. 86
Pinks, A. H. G. 317
Piombino, A. J. 362
Pirog, J. A. 203
Pitaud, J. 179
Pitt, E. H. 85
Planalp, R. N. 282, 352
Plants, K. D. 400
Plesch, P. H. 338
Ploum, A. J. W. 218
Pobereskin, M. 55
Pocalyko, A. 270
Polentz, L. M. 114
Polyakov, A. L. 150

Popiel, J. M. 22
Popp, C. L. 356
Popper, H. 33
Porth, H. 282
Post, A. H. 446
Post, C. B. 337
Posten, R. S. 467
Potter, J. H. 294
Poulallion, P. 174, 214
Powell, B. 285
Powers, M. L. 96
Polynter, W. G. 399
Prager, M. J. 349
Pratt, H. R. 412
Prausnitz, J. M. 43, 236, 305, 466
Pregermain, S. 139
Preston, S. T., Jr. 114
Price, D. 81, 235
Price, M. A. 293
Prigg, J. A. 71, 187
Prout, G. B. 241, 275, 386
Puff, W. 223
Pullo, A. 305
Pulpan, H. 353
Puncochar, R. 227
Purchell, J. E. 271
Purkis, C. H. 293
Purkiss, B. E. 463
Pytel, E. J. 413

Q

Qader, S. A. 219
Quarles, B. 286
Quartulli, O. J. 223
Quibel, J. H. 141
Quigley, J. M. 310
Quon, D. 86

R

Raask, E. 289
Rackett, H. G. 298
Rademacher, R. J. 458
Radford, H. D. 183
Rafibeili, N. M. 58
Rager, E. J., Jr. 2
Raley, J. E. 134
Rall, H. T. 320
Ramaswamy, A. V. 219
Ramayya, G. A. 425
Ramey, J. T. 247
Ramsey, M. A. 332
Rao, V. V. 383
Rapp, D. 382
Rassmuss, J. E. 242, 283
Rastogi, R. P. 200
Ratai, W. 56, 73
Raub, S. H. S. 349
Rausch, H. 377
Ravussin, P. 126
Ray, K. P. 251
Rayner, J. P. 194
Rayner, R. E. 79
Read, D. 257, 290
Rebbert, R. E. 105
Reckhard, J. W. 460
Redfearn, M. W. 410 (3)
Rees, D. R. 129
Reed, P. 48
Reed, R. D. 110, 262, 263, 369
Reed, R. J. 111, 265
Reed, III, T. M. 382
Reese, R. M. 383
Regan, T. J. 92
Regeimbal, N. 329
Rehfield, L. W. 359
Rehnberg, J. D. 150
Reich, H. J. 341
Reid, L. J., Jr. 58
Reid, L. S. 98, 328
Reifer, J. C. 70
Reif, H. E. 184
Reiffel, L. 77
Reising, G. F. S. 339
Reiter, W. 460
Rennick, G. E. 467
Renouard, P. 143
Reshotko, E. 381
Resibois, P. 44
Reynolds, G. P. 213
Reynolds, M. M. 101
Rhind, W. 327
Rhodes, A. F. 115, 374
Riback, M. 292
Rice, C. H. 325
Rice, R. E. 55
Richards, H. T. 179
Richards, J. S. 259
Richards, L. W. 307
Richards, P. L. 5
Richter-Bernburg, V. G. 90
Richter, K. 159
Rickles, R. N. 411
Ridgway, K. 299
Riendl, J. A. 131
Rightmire, R. A. 315, 349
Riley, E. A. 398
Riley, R. D. 294
Rinesch, R. 104
Rintoul, B. 15, 319
Rioult, A. 75
Ripperton, L. A. 369
Rittenhouse, F. S. 292
Rizzone, M. L. 2
Roach, J. W. 169, 249
Roback, R. 204
Robb, W. E. 369
Robbins, W. H. 381
Roberts, A. G. 256, 325
Roberts, A. L. 235
Robertson, J. 226
Robertson, J. L. 35, 225
Robinson, D. B. 272
Robinson, D. J. 291
Robinson, R. L., Jr. 380
Robinson, W. R., Jr. 138
Roche, P. A. 314
Roddis, L. H., Jr. 54
Rodgers, J. B. 239
Roeder, J., Jr. 262
Rogers, G. F. C. 40
Rogers, L. C. 6, 131, 133, 211, 247, 353
Romero, M. A. 413
Romero, N. 236
Romine, H. E. 36
Ronicker, F. J. 173
Rood, L. H. 190
Rooke, D. E. 407
Rooney, J. J. 22
Rosenberg, Y. I. 33
Rosenkranz, Z. 201
Ross, R. W. 28
Roth, E. A. 237
Roth, E. R. 129
Roth, S. E. 229
Rouannet, M. 298
Roudebush, W. H. 63, 180
Rough, R. L. 467
Round, J. R. 232
Routley, A. F. 231
Rowland, L. O. 135, 443
Rowlands, J. C. 152
Ruault, P. A. 377
Rubin, S. G. 123
Rudinger, G. 39, 306
Rudzik, R. L. 442
Runge, K. 418
Runyan, H. L. 321
Rupprecht, W. E. 85
Ruskin, V. W. 461
Russell, R. D. 271
Russell, R. J. 176
Russell, T. W. F. 423
Russell, W. W. 220
Russo, J. 118
Russu, R. 258
Rutherford, R. J. 361
Rutledge, R. M. 307
Ryan, F. 271
Ryan, F. M. 373
Ryan, I. K. R. 123
Ryan, K. R. 123
Ryan, R. S. 252, 286
Rybak, T. B. M. 335
Rydberg, J. A. 264
Rzad, S. 238

S

Sadykh-Zade, E. S. 58
Sage, B. H. 339
St. Clair, T. A. 78, 230
Sakharnov, V. A. 83
Salathe, R. E. 52
Sales, M. 144
Salvi, G. 364
Salvino, S. M. 275
Samans, C. H. 35
Sams, J. R. 425
Samuels, W. E. 51
Sander, N. J. 318
Sandercock, D. M. 34
Sandstede, G. 159
Sarapuu, E. 95
Sargent, R. W. 263
Saturno, A. F. 307
Saunders, J. E. 209
Savic, P. 156
Savini, C. G. 237 (2)
Savino, J. M. 122
Sawler, I. J. E. 231
Sawyer, G. H. 398
Saxena, S. C. 342
Schaeffer, R. J. 444
Scharf, H. B. 181
Scheidegger, A. E. 353
Schippers, J. 142
Schitnik, G. 141
Schlesinger, M. D. 67, 364
Schlict, H. 283
Schlumberger, E. M. 218
Schmid, B. K. 183
Schmidt, H. R. 222
Schmitz, R. A. 158
Schneider, J. E. 285
Schneider, W. E. 95
Scholes, G. 59
Scholes, W. A. 20
Scholler, F. 379
Schonewald, R. 360
Schrader, C. A. 26
Schrader, E. W. 79
Schreiber, J. 349
Schreuders, A. 173
Schrockenfuchs, G. 354
Schroder, C. E. 362
Schroeder, G. B. 294
Schroeder, R. E. 358
Schroter, J. 202
Schuder, C. B. 79
Schuetzenduebel, W. G. 121
Schuh, H. 41
Schuhknecht, W. 421
Schultz, J. F. 103
Schumann, P. A. 372
Schuss, J. A. 294
Schustack, R. E. 146
Schwabe, K. 349
Schwartz, A. B. 58
Schwartz, R. J. 131
Schwartz, S. A. 186
Schwerdtfeger, W. J. 196
Scott, A. F. 275
Scott, G. S. 381
Scott, J. 351, 353
Scott, M. F. 402
Scott, T. J. 427
Seaborg, G. T. 7
Sebastian, E. J. 328
See, W. G. 263
Segeler, C. G. 94
Segnar, S. F. 176
Seibold, J. G. 94
Seitz, C. A. 83
Sekine, T. 183
Selim, F. E. 147
Sellmaier, A. 117
Sen, M. 405
Sergienko, E. R. 272
Serif, M. 309
Sevbo, P. I. 83
Severin, W. J. 252
Severs, R. K. 338
Shah, K. K. 157
Shalt, H. 52
Shamardin, N. N. 143
Shamp, F. F. 416, 445
Shannahan, J. H. K. 275
Shannon, J. S. 340
Shanstrom, R. T. 209
Shapiro, H. 421
Shaw, R. M. 92
Shearing, D. 98, 191, 251
Shebalin, I. Yu. 19
Sheeler, J. E. R., Jr. 171
Sheldon, C. W. 79
Sheriff, N. 40
Sherlock, J. E. 109
Sherwin, S. F. 89
Sherwood, P. 387
Sherwood, P. W. 116, 224, 347, 421, 431
Shobert, W. R. 466

Shore, J. B. 281
Short, B. E. 297
Short, D. T. 227
Shpakovsky, V. I. 135
Shriver, W. B. 445
Shropshire, J. A. 348
Shulz, J. W. 385
Shultz, J. F. 325
Sidorenko, M. V. 135
Sieck, L. W. 203, 204
Siegel, R. 122
Siegel, S. 114
Sigafoos, D. H. 307
Siggelin, G. K. A. 355
Sigmund, K. 379
Silverman, M. P. 64
Simon, J. 119
Simpson, P. B. 376
Sinclair, T. F. 96
Sinfelt, J. H. 64, 305, 423
Skeats, A. E. 70
Skomoroski, R. M. 139
Sleeman, D. B. 26
Sliepcevich, C. M. 21
Slobod, R. L. 56
Small, N. J. T. 235
Smee, P. G. 192
Smirnov, K. K. 135
Smith, A. H. 367
Smith, A. M. O. 202
Smith, A. W. 191
Smith, C. E. 119
Smith, C. W. 334
Smith, D. L. 250
Smith, E. L. 361
Smith, E. S. 16, 100
Smith, F. L. 347
Smith, H. L. 36
Smith, J. M. 380 (3)
Smith, J. W. 273, 424
Smith, L. 292
Smith, N. D. 326
Smith, R. E. 214
Smith, V. C. 373
Smith, W. C. 395
Smith, W. N. 428
Soda, T. 38
Soderholm, L. G. 73
Solacolu, S. 258
Sollami, B. J. 320
Solomon, J. L. 79
Solomon, R. E. 30
Soltis, R. F. 34
Somerscales, E. 122
Sommer, E. C. 254
Sonnek, A. A. 83
Soo, S. L. 42
Sova, O. 460
Spacil, H. S. 349
Spangler, A. T. 127
Spaulding, A. O. 169
Spears, D. A. 397
Speel, L. 284
Spengler, G. 326
Spolan, I. 381
Sprague, J. W. 113
Sproull, W. T. 237
Squires, R. G. 265
Srivastava, A. C. 356
Staats, W. R. 321
Stacey, J. S. 271
Staes, K. 88
Stagnito, H. 396
Stahel, E. P. 40
Stahl, N. 49
Stahl, R. W. 127
Staib, C. 145
Stanley, H. M. 326
Stannard, J. H., Jr. 20
Starner, K. E. 51
Stearns, J. F. 49
Stegeman, A. J. 432
Steiner, H. 220
Steinhofer, A. 327
Steinsberger, J. C. 117
Stephens, E. R. 293
Stephenson, W. H. 458
Stern, E. W. 223
Stern, S. A. 96
Sterner, T. E. 235
Sternlicht, B. 417
Sterrett, E. 60, 174, 214, 228, 356, 400
Sterry, G. 57, 161, 242, 315
Stettenbenz, L. M. 55
Stevens, K. L. 271
Stewart, W. E. 236
Steymann, E. H. 336
Stief, L. J. 425
Stiel, L. I. 384
Stierlin, H. 113
Stone, J. A. 203
Stone, R. N. 84
Stormont, D. H. 133, 220, 222
Storp, K. 356
Strelzoff, S. 63
Stretton, J. L. 308
Strong, W. A. 22
Strunk, M. R. 341
Stuart, F. 455
Stubbeman, R. F. 42
Stuiver, W. 361
Stump, W. J. 328
Stutesman, H. L. 154
Subramanyam, M. V. 382
Suggitt, R. M. 393
Sugino, K. 183
Sullivan, C. P. 337
Sullivan, E. P. 292
Sun, H. T. 470
Sutcliffe, H. 81, 235
Suter, V. E. 171
Sutherland, W. A. 40
Sutphin, E. M. 183
Sutton, G. W. 9
Svec, H. J. 155
Swaminathan, V. S. 259
Swanson, C. B. 187
Sweeney, T. L. 468
Sweeny, H. C. 299
Swingholm, S. 14
Swiss, M. 162 (2), 255, 403
Sworski, T. J. 203, 469
Sykes, J. H. M. 89, 314
Szell, C. 110
Szepesey, L. 119
Szirmay, L. V. 234

T

Tabikh, A. A. 422
Tabor, E. C. 119
Tafreshi, H. H. 439
Tai, J. C. 237
Takagi, K. 222
Talaat, M. E. 246
Talkington, G. E. 398
Talvenheimo, G. 8
Tanaka, I. 380
Tarmy, B. L. 348
Tarver, G. W. 462
Tate, R. W. 299
Taylor, A. R. Jr. 201
Taylor, C. C. 177, 438
Taylor, W. F. 64, 305, 423
Teekens, C. 335
Teichner, S. J. 22
Teller, E. 245
Tennant, H. L. 343
Teranishi, R. 271
Teyki, I. F. 183
Thacker, B. G. 440
Thacker, R. 128
Theeuwes, F. 88
Thiesen, C. J. 26
Thodos, G. 157, 273, 308 (2), 339, 382, 423, 425, 469
Thomaes, G. 239
Thomas, B. W. 270
Thomas, J. W. 149
Thomas, O. A. 87
Thomas, P. M. 110
Thommen, H. U. 160
Thompson, B. H. 364
Thompson, C. J. 320
Thompson, R. D. 261
Thompson, V. B. 75
Thorn, J. D. 393
Thorne, L. C. 91
Thring, M. W. 53, 158
Thurlow, C. 299
Tiedje, J. L. 54
Tien, L. C. 468
Tiller, T. R. 108
Timmerhaus, K. D. 288
Tippy, W. B. 138
Titov, L. N. 150
Todd, C. A. 381
Todd, D. B. 213
Todd, T. W. 11
Toles, G. E. 180
Tomsic, V. J. 297
Toncre, A. C. 461
Topse, H. F. A. 355
Townsend, F. M. 98
Townsend, G. E. 263
Toxopeus, E. J. G. 126
Tozer, B. A. 159
Tracey, V. A. 129
Tragert, W. E. 349
Trainer, T. M. 154
Trass, O. 383
Trella, R. D. 144
Tranwith, A. B. 120
Trimble, J. C. 284
Trinks, W. 23
Triolo, L. 305
Tripp, W. 470
Trolano, A. R. 301
Troupe, R. A. 373
Trowell, J. M. 304
Tscho, A. 349
Tsuchiya, H. M. 229
Tsui, K. 338
Tuba, I. S. 167
Tugendhat, G. 276
Tuggle, G. B. 461
Tulupov, V. A. 65
Turner, R. M. 36
Turpin, D. G. 22
Tuttle, W. N. 120
Tyler, F. 25
Tyson, R. F. S. 340
Tyul'panov, R. S. 60

U

Uhl, A. 252
Uhl, A. E. 253, 321
Uline, L. J. 349
Ulrichson, D. L. 158
Unzelman, G. H. 450
Urbain, G. 298
Urone, P. 304
Uyehara, O. A. 293

V

Vahldieck, N. P. 96
Vaidyeswaran, R. 219
Van Bladeren, J. 419
Van Fossan, N. E. 323
Van Geet, A. L. 306
Van Hees, W. 128
Van Hook, W. A. 200
Van Horn, M. F. 448
Van Itterbeek, A. 88
Van Leeuwen, J. M. J. 43
Van Oeteren, K. A. 463
Van Poollen, H. K. 96, 284, 354, 439
Van Rysselberghe, P. 307
Van Wazer, J. R. 38
Van Wyk, J. M. 150
Vanco, M. R. 158
Vannah, W. E. 244
Vanness, H. C. 237 (2)
Vasak, V. 199
Vaughn, H. E. 180
Veillon, C. 151
Veprek, J. A. 200
Verbeke, O. 88
Veron, J. 271
Versagi, F. J. 122, 385
Vervalin, C. H. 50
Verzele, M. 271
Vickers, H. H. 53
Viens, C. H. 222
Vierbuchen, R. C. 314
Virgoe, H. G. 200
Vitalli, G. 134
Voelkerding, F. J. 328
Volpi, G. G. 42, 203
Von Aulock, V. K. 227
Von Bogdandy, L. 451 (2)
Von Lehmden, D. J. 293
Vonnegut, B. 236
Vozoff, K. 8

W

Wachal, A. L. 457
Wadman, B. W. 292, 455
Wadsworth, G. W. Jr. 48, 275
Wagner, E. O. 182
Wagner, J. A. 51
Wahl, H. A. 394
Wakao, N. 380 (3)
Wakefield, W. W. 282
Wakeland, H. H. 77
Waldron, L. J. 375
Waler, D. M. 182
Walker, I. C. 384
Walker, J. W. 398
Walker, R. D. Jr. 341, 465
Walker, T. 319
Wall, I. 280
Wall, W. B. 131
Wallace, T. J. 139
Walsh, R. 382
Walstad, A. T. 263
Walters, J. G. 199
Walton, E. 30
Wananmacher, J. M. 280
Wang, D. I. J. 43
Ward, A. L. 383
Ward, C. P. 235
Ward, J. 235
Warman, J. M. 383
Wasmund, B. 424
Wasp, E. J. 92, 258
Watanabe, I. 404
Waterfall, F. D. 118
Waterhouse, L. 141
Watkins, C. H. 257, 290
Watkins, K. W. 204
Watson, P. K. 157
Waxman, M. 198
Way, S. 167
Weast, R. C. 192
Webb, A. N. 393
Webb, E. A. 249
Webb, G. 22
Weber, A. 419
Weber, E. J. 75, 263 (2)
Weber, G. 243
Webster, C. J. 396
Weekman, V. W. Jr. 220
Weeks, L. G. 435
Weh, H. 245, 246
Weinstein, M. B. 371
Weinstock, I. B. 393
Weintraub, M. 306
Weir, J. 371
Weiss, A. J. 279
Weiss, G. 264
Weiss, M. A. 349
Wellman, P. 64
Wells, P. B. 219
Wells, R. A. Jr. 292
Wen, C. Y. 221 (2)
Wendt, B. 436
Wenzel, A. C. 139
Werden, R. G. 73
West, J. M. 55
Westaway, M. T. 160
Westerman, P. H. 338
Wetherington, T. I. Jr. 166
Weyermuller, G. 151, 164
Wharton, D. R. A. 117
Wharton, M. L. 117
Wheeler, A. E. 144
White, B. 319
White, D. A. F. 386
White, D. G. 412
White, E. A. Jr. 9
White, J. C. 279
White, M. J. A. 314
White, R. A. 268
Whitehead, C. 406, 452
Whitehorn, V. J. 207
Whiting, M. S. 87
Whitley, W. W. 248
Whittelsey, C. C. 264
Whittle, F. 168
Widmaier, O. 421
Wiesener, W. 349
Wilde, D. J. 335
Wiley, C. 320
Wilkins, D. M. 256, 289
Wilkinson, J. F. 60
Williams, A. 296
Williams, D. J. 123
Williams, G. 210
Williams, G. D. 57
Williams, J. C. 250
Williams, N. J. 129
Williamson, W. R. 350
Willis, C. M. 395
Willis, R. B. 238
Willmott, A. J. 39
Wilson, D. 190
Wilson, G. G. 387
Wilson, H. 13
Wilson, H. M. 51, 344
Wilson, H. N. 422
Wilson, J. E. 181
Wilson, W. B. 55, 227
Wiltfang, W. C. 374
Windsor, L. H. 181
Winefordner, J. D. 151
Winter, E. R. S. 422
Winterhalter, D. R. 237 (2)
Witcher, H. A. 173
Withers, B. 261
Witherspoon, R. R. 52, 93
Wittgenstein, G. F. 253
Wobig, A. 109
Wodetzki, C. M. 203 (2)
Wolfgang, G. H. 34
Wolfson, D. E. 181, 289
Wood, F. C. 257
Wood, G. B. 341
Wood, R. 62
Woodberry, N. T. 350
Woodcock, A. A. 98
Worchester, D. A. 321
Wormald, C. J. 383
Worsham, C. H. 349
Wray, J. L. 435
Wright, C. C. 152
Wright, J. H. 280
Wright, J. S. 264, 265
Wright, L. H. 127
Wrobel, J. 257
Wunder, J. W. 54
Wunsch, W. 223
Wurth, J. 389
Wyllie, M. R. J. 219
Wyma, B. H. 336
Wynkoop, R. 212
Wyszynski, Z. S. 209

X

Xenis, C. P. 118

Y

Yamamoto, K. 447
Yamura, A. 183
Yang, W. J. 468
Yarborough, L. 380
Yarwood, T. A. 139
Yarze, J. C. 326
Yates, D. J. C. 64, 305, 423
Yeager, E. B. 93
Yeager, P. R. 84
Young, E. C. 179
Young, E. H. 297
Young, J. E. Jr. 237
Young, R. B. 297
Young, W. E. 167
Yousoufian, H. H. 148

Z

Zabetakis, M. G. 381
Zagst, E. F. 397
Zaitsev, O. S. 148
Zalavadia, J. V. 411
Zaman, M. Q. 311
Zandstra, K. A. 395
Zenz, F. A. 201
Zermuehlen, R. O. 144
Zglenicki, C. 100
Zhuravlev, L. T. 150
Ziegler, E. N. 40, 238
Zienty, F. B. 423
Zimmerman, J. J. 373
Zimmerman, O. T. 230
Zimmerman, J. 81
Zink, J. S. 369
Zinman, A. L. 367
Zollfrank, L. 349
Zopfi, W. L. 119
Zubarev, A. F. 150
Zukoski, E. E. 87
Zulian, A. 76
Zurbrigen, J. A. 117 (2)

SUBJECT INDEX

A

ABSORPTION
CO_2 from natural gas, process 64
gas in a fin-wall conduit 468
liquid phase equilibria, modecular sieve absorbent 236
packaged gas absorbers 333
triple-venture packaged system 415

ACETYLENE
detector cell capacitor, high sensitivity 33
diffusivity of in-Newtonian liquids 236
excitation of by low energy electron beams 87
hydrogenation on Pt 219
ion-molecule reactions in 203
oxygen reaction, shock tube 42
radiolysis of 204
recovery from gaseous mixture, method 362
transition-metal catalysts, -bonded intermediates, hydrogen reactions 22

Production
from hydrocarbon-oxygen mixtures 324
from methane and low hydrocarbons 140
Wulff unit, Europe 206

ACRYLONITRILE
U.S. plant construction in U.S.S.R. 47

Production
process, SNAM 68
from propylene 140

ADSORPTION
attractive forces at interfaces 37
gas condensate mixtures 58
hydrocarbon, galvonstatic, volumetric studies, fuel cell 8
methane-propane on silica gel 24
molecular sieves, capacity 24
polymer on surfaces 120
surface diffusion of adsorbed molecules 304
surface study of low energy diffraction 304
system, simulation of 120

AIR CONDITIONING
absorption cooling system 262
absorption cooling systems, defrosting of 113
absorption, liquid ammonia-salt systems application 308
absorption refrigeration system 371
absorption system, hospital, Ill. 27
air conditioners, sales 309
Airajust method for single story buildings 454
apartment construction market 314
brewery process 225
building energy requirements 456
business center, Occidental Center, Los Angeles 410
central, promotion as standard equipment for homes 391
central heating and cooling plant, Nassau Bay, Tex. 112, 190, 295, 329
central heating and cooling plant concept, projects 292
central heat-cooling system from public utility, Allegheny Center, Pittsburgh, Pa. 264, 292
central plant, water, Reston, Va. 367
church, LP-gas fired, St. Louis, Mo. 224, 331
classes, mfg. co. 387
computer control of in building 372
cast, comparative analysis 326
cost, office buildings, winter climates 108
design, heat balance concept 367
design by computer 461
design consideration for air distribution 148
electric, condominium, Sea Bright, N.J. 309
electric, eye clinic, Fergus Falls, Minn. 316
electric, office bldg., John Hancock Center, Chicago 343
electric, office building, Kane, Pa. 316
electric, promotion in homes 391
electric *vs.* gas, hospital 343
electric *vs.* gas, markets 385
electric *vs.* gas, multiroom buildings 310
factory, cost savings 367
gas engine-compressor use, department store, Brooklyn 292
gas engine-compressor use, factory, Minneapolis 187
gas engine driven system, federal building, Minneapolis 293, 367
heat pump, air source cascade 73
heat pump, high school, Kimberly, Wis. 56, 73
heat pump, condominum, Fort Lauderdale, Fla. 367
by high lighting load, office bldg., Canada 368
high school, McAllen, Tex., costs 458
high schools, climate and non-climate controlled comparison 455
hospital 27, 144, 326
hotel 410
insulated flexible duct installation at exhibit site 410
leasing plan, gas co., economic payoff 27
lighting room load 108
load estimation, study of common assumptions 454
ocean liner 225
performance prediction of systems 144
piping, labor estimating, component method 367
refrigeration apparatus, reverse cycle 70
refrigeration apparatus, thermostat control 71
solar energy for 167
solar-gas absorption cooling, heating system, mathematical model of 293
space needle, world's fair 27
system, insurance bldg., Minn. 366
system, life insurance complex, Los Angeles 367, 368
system, multi-story bldgs. 366
system, shopping center, Winter Park, Fla. 368
system for multi-room buildings 108
thermoelectric 95
U.S.S.R. industry 70

AIR DISTRIBUTION
makeup air 28
secondary air supply 28

AIR POLLUTION
abatement program, chemical co. 108
chromatograph-combustion-infrared analyzer 338
control, federal interagency relations 411 (2)
control, market for gas 275
diesel exhaust, control laws, Europe 411
dispersion coefficient, emission from stacks 293
nitro-olefins detection 293
polynuclear hydrocarbon emissions from industrial processes 293
sampling by plastic bags 422
SO_2, concentrations downwind of tall chimneys, power station 410
SO_2, effect of increased chimney height on ground level concentrations, power station 410
SO_2, effect of land configuration on flue gases dispersion, power station 410
SO_2 removal, electrostatic precipitator 145
SO_2 role, analytical tracer technique 304

ALLOYS
aluminum, developments 336

ferrous, developments 336
high-temperature, power station increased efficiency 419
ALUMINA
CO removal, catalyst preparation 22
AMMONIA
acrylonitrile production 68
ammonium ions produced by radiolysis, mass spectrometric study 305
anhydrous, liquefied, 9-story tank 446
anhydrous, low temperature storage, plant, Calif. 402
anhydrous, production, fertilizer plant 259
anhydrous, storage container 360
capacity growth 362
catalytic oxidation on Pt-Rh 305
food processing use, central plant 392
heavy water from 183
liquid, solubility of methane in 469
M. W. Kellogg reforming furnace process 404
moderator coolant, thermodynamic properties 204
pipeline, Mexico, 46
plant, all-centrifugal, Monsanto, La. 288, 404
plant, CO_2 removal, modified hot-carbonate process 320
plant, high pressure air-fin condensor 371
plant design and investment 289
plant expansion in Midwest 21
plants, innovations 324
plants, directory, U.S., Canada 5
plants, new generation, Olin, Mathieson Chem. 448
recovery from coke-oven by ammonium phosphate 102
shock tube reaction between D_2 and NH_3, mechanism 87
Production
catalyst, synthesis gas, cost reduction 64
catalytic reforming developments 223
Marshall steam cycle process, plant 139
methane, partial oxidation 64
processes, review 63
Sulfinol process, evaluation, acid-removal operations 14
ANALYTICAL INSTRUMENTS
analog computer resolves analytical curves 464
apparatus for characterization of chain-carriers in polymerizations caused by acids or syncatalysts 338
camera measuring infrared energy of object 150
C-H-N analyzers 338
combustion-chromatograph-infrared analyzer, air pollution 338
detector for water vapor in a gas 338
developments 270
dielectric element for measurement of thermal conductivity, pressure and velocity of gases 200
dielectric test cell for investigating conduction in insulating liquids and solids 157
engine and compressor performance 298
fluid saturation in cores measurement by gamma-ray absorption 157
helium analyzer, portable 83
hydrocarbon content of gas, measurement of 200
hydrogen flame ionization detector 226, 227
infrared gas analyzer 84
interface detection, dielectric constant technique 107
interface detector, products pipelines 379
maintenance costs, trends 229
manometer, H_2 in steel determination 150
manometer for low gas and vapor pressures 150
process analyzers 119, 155
process instrumentation 270
process instrumentation, maintenance education 33
pyrometer, photoelectric 298
recording, photography, mass spectra 37
spectrophotometer 83
stagnation point heat flow meter 199
surface measurement and inspection, review 465
thermal conductivity cells 234
transducer for PVT measurements 198
transducer, null-type, measurement of pressure of corrosive gases 464
ANALYTICAL METHODS
fuels, solid and gaseous, review 199
multiparticle systems 39
petroleum, review 199
shale composition, Alberta, Can. 57
ANNEALING
butt-welded joints, high speed strip 109
plant 195
APPLIANCES
air conditioners, sales 309
approval testing, Gt. Brit. 293
clothes dryer, gas and electric heater for 29
clothes dryer, heat reclaimer for 29
clothes dryer model, Hamilton Manufacturing Co. 226
connector performance factors 411
conversion of solid- and oil-fired to gas 329, 454
design 454
dishwasher with own gas water heater 454
effects of elevated gas pressure on performance 411
fryer, gas-fired 368
gas ranges, selling features 431
leasing program, gas co. 145
LP-gas, market 309
LP-gas, sales campaign 30
manufacture trends, world 343
market, France 161
oven, infrared 368
plastics use 302
pressure regulators 366
radiant food warmers 368
ranges, panel manufactures for 225
research, A.G.A. labs 312
sales, East Midland, Gt. Brit. 48
sales promotion 161, 431
standardization, hoses for connection of 262
ARGON
anomalous shock velocity measurements 42
solubility in hydrocarbon, cryogenic temperatures 43
AUTOMATION
alcohol distillation, performance simulations 32
centrifugal compressor, surge prevention 15
compressor station, Pacific Lighting Gas, Calif 442
control center, pipelines 359
control of degassing stations, Brit. Petrol. 440
correcting communications channel failures 285
documentation 4
engineer's training 2
gas dispatch control, potential for 400
gas measurement 441
gas wells, compressors and processing plants 59
heat treating and hardening, metallurgical furnace 30
high pressure pipelines, North Wales 402
human engineering, applied to pipeline control 176
hybrid computer, advantages 32
instrumentation, compressors, remote stations 16
pipeline, current problems, survey 441
pipeline and compressor simulation 174
pipeline applications for control computers 441

refinery, optimum operation, computer use 5
remote meter reading 78
residental meters, remote readings 32
social implication 3

B

BACTERIA
growths on natural gas 394
materials breakdown by, tests for 466
methane oxidation 64
protein from oil, French research 395
water pollution, gamma radiation, sedimentation rate 10
BEARINGS
carbon-graphite, friction and wear characteristics 466
gas, flow control analysis, elastic orifices for 409
gas lubricated 28
BENZENE
Production
developments 129
from coke oven light oils, Litol process 181
by hydrodealkylation, Houdry Detol process 324
BLAST FURNACES
control, tuyere-gas energy relationships in 412
control of hearth heat, equations 412
fuel injection, kinetics of 202
hydrocarbon injection into 190
BOILERS
conversion to gas 329
heat storage capacity 121
Heatmaster, Gt. Brit. 413
waste gas converters, pneumatic control system 139
BURNERS
aerated, methane 71, 187, 262
air-heater 369
air supply apparatus 262
bray jets, hydrocarbon-rich gases 29
construction 263
control, automatic gas regulating system 113
digital control system, steam generators 294
effects of elevated gas pressure on performance 411
fan shaped flame 263
flame arrestor 109
flame control 92
Flashrite burners in refractory tunnel 226
fluid fuel apparatus 263
furnace wall 71
ignition, automatic 294
ignition, multiple spark, Gas Council, Gt. Brit. 454
industrial 263
industrial, air/gas proportioning techniques 262
industrial, application of vinyl plastic coating on steel 295
infrared 71
infrared for cooking appliances 71
infrared for tiles 265
liquid and gaseous fueled 109, 110
nozzle-mixing, tunnel, design and control 225
nozzle mixing type 369
pilot control 76, 76
pressurized 71
pulse jet starter 113
radiant 263
radiant heat 369
radiant with internal mixture distributing means 110
radiant tube, self-stabilizing diffusion type 369
range top, thermostatically controlled, performance study 412
reasearch, Midlands Research Station, Solihull 412
safety cut-off 109
secondary air supply 28
spark ignition system 263
spark ignition system with ignition indicator 263
spider type 110
spray-type, design of 412
submerged 72, 110
using air above 1 atm 109
vertical adjustment device 110
BUTANE
adsorption and decomposition on Pt black 182
alkanes, mass spectrometric, high pressure 38
enthalpy changes upon vaporization in *n*-butane-*n*-decane system 339
interfacial tension, CO_2-*n*-butane system 340
interfacial tension, methane-*n*-butane system 340
isomerization of 148
viscosity 426

C

CALIBRATION
gas composition sensitive pressure gases 84
Lorentz force calibrator for MGD interaction coils 156
pressure sensing devices, circuits 114
CALORIFIC VALUE
adjustment by Wobbe gas index regulation device 145
gases, determination 234
CALORIMETRY
aneroid semi-micro reaction calorimeter 199
fluorescent luminar 108
isothermal throttling calorimeter system 380
thermal instrumentation, advances 268
thermometric titration calorimeter 270
CARBON
oxidation of, kinetics 340
pyrolytic, structure deposited in fluidized beds 341
CARBON BLACK
explosion data 127
Production
from coal, cost, U.S. Bur. Mines process 449
from liquid hydrocarbons, furnace process 448
CARBON DIOXIDE
absorption from natural gas, process 354
analysis in natural gas by critical flow bridge 270
CO_2 welding, field results, savings 18
detector cell capacitor, high sensitivity 33
determination by gas chromatography 304
diffusivity of in non-Newtonian liquids 236
interfacial tension, CO_2-*n*-Butane system 340
ionization cross section 382
recovery from gaseous mixture, method 362
self-diffusion coefficient 423
solid, solubility in liquid solvents at low temperature, thermodynamic method 305
sulfinol process, evaluation, acid-removal operations 14
Removal
from air by absorbents 320
from NH_3 synthesis gas, modified hot-carbonate process 320
from hydrocarbons 133
from natural gas, process 439
sulfinol process 171
treating gas mixtures with K CO solutions, steel corrosion inhibition method 285
CARBON MONOXIDE
alarm device 33
detection, pallado-sulfite silica gel tube 465
detector cell capacitor, high sensitivity 33
determination in air 303
determination by gas chromatography 304
electrochemical oxidation of 159
ionization cross section 382
reduction, Lurgi shift conversion plant, Gt. Brit. 290

vibration-vibration energy exchange between CH_4 and C 383
volatile gases in hydrocarbon, cryogenic temperatures 43
zeolitic molecular sieve process 355
Removal
from H_2 containing gases, catalyst preparation 22
CATALYSIS
cyclopropane with hydrogen over nickel, reaction products distribution 305
heterogeneous, catalytic reactors 22
hydrocarbon autoxidation with metal catalysts 139
industrial, research 289
methane-deuterium exchange over Pt-Rh alloys 339
surface study by low energy diffraction 304
CATALYSTS
activity in dehydrogenation of paraffinic hydrocarbons 272
Alumina and silica alumina, exchange of hydroxyl groups with deuterated methane 469
CO removal, preparation of 22
catalytic sites within intra-crystalling structures 363
cobalt and Mo oxides, W and Ni sulfides, hydrogenation of petroleum fractions 219
computer use in catalyst specifications in process design 268
CuO, catalytic combustion of ethylene, effect of preparation 405
dehydrogenation, Kinetics of regeneration of, Houdry Process 273
difference characterization by cumene cracking kinetics 238
electrical conductivity, zinc oxides, ethylene, hydrogenation 22
ethylene dimerization 102
ethylene polymerization, tert-butylperoxy isopropyl carbonate 22
fluid cracking, Socony Mobil Oil 220
hot gas recycle process, developments 182
hydrocracking, developments 206
hydrogenation, zinc stearate 65
iron, sulfur poisoning, Fischer-Tropsch synthesis 103
metal, hydrogenolysis of ethane 64
metals in hydrocracking 220
molecular sieves 67, 258
nickel, effect of organic sulfur compounds on 59
nickel oxide, surface area changes 422
particle size effect on, hydrogenation of ethylene on Ni 363
platinum black activity, butanes, adsorption and decomposition 182
pore systems studies 305
porous, diffusion and flow through 380
porous, effect of pressure gradients 380
porous, volume change effect on gas-phase reactions 220
silica-alumina, desorption of olefins from 380
solid, gaseous diffusion rate measurement 236
surface area of Co, hydrogenolysis of ethane 423
synthesis gas production, hydrogen and ammonia production, cost reduction 64
temperature measurement, hydrogenation of CO on Fe and Ni 325
transition-metal catalysts, π-bonded intermediates, hydrocarbon reactions 22
tungsten in hydrocracking 325
zeolites, catalyst markets 23
CATALYTIC CRACKING
cumene, kinetics of 238
ligroine, town gas production 141
pneumatic control system for waste gas converters 139
CATALYTIC REFORMING
benzene, UGI-CCR system 141
continuous, development of processes 450
high pressure, developments 223
natural gas, fertilizer plant 259
natural gas-air plant, Hungary 184
steam, thermodynamics of 406
steam, town gas production, waste heat recovery economics 327
Light Petroleum Distillates
catalytic rich gas process, Midland Res. Station, Gas Council, Gt. Brit., 223, 450, 451
Grande Paroisse process, naphtha, ammonia production 141
heating gas production, naphtha, domestic use, Pullman. Inc. 326
ICI process 66, 141, 142 (2), 223, 429
ICI process, Cadwell Lane plant, Hitchins, Gt. Brit. 327 (2) 364
plants, see gas plants
processes, review 15, 140, 331, 256, 364
Stazione Sperimentali Combustibili process 364
synthesis gas and town production from naphtha 223
town gas production from naphtha, Chemical Construction Corp. 326
CATHODIC PROTECTION
advances in 195
aluminum 115
current density required for 231
deep-well ground bed 196
distribution piping, low output rectifiers for 269
drilling deep well anode beds 151
lead-silver alloy naodes, performance in sea water 375
mains, existing, installation cost feasibility 300
marine pipeline exeprience, petroleum co. 461
methods for locating remote anode ground beds 375
natural gas transmission line usage 80
quality control, cost effect 80
rectifiers checked by radio 375
soil resistivity data, Natl, Bur. Stds. 196
stress-corrosion cracking prevention by 418
system for deep sea moor 375
thermoelectric generators for 418
CHEMICAL REACTIONS
reciprocity relation between rates and affinities of simultaneous 307
CHEMILUMINESCENCE
acetylene-oxygen reaction 42
CHROMATOGRAPHY
apparatus, fuel gas analysis 303
carcinogenic polynuclear hydrocarbons in petroleum waxes 235
chromatograph use in gas recovery unit 199
cigarette smoke, hydrocarbons containing oxygen and nitrogen 271
coated capillary columns quantitative analysis 36
column diameter expansion by plate, flow homogenizer, Conoco 156
concentration of trace impurities in gases, method 199
electric discharge detector 377
flow programming 200
fuel gas constituents determination 235
gas-liquid, peak identification 119
gas separation, Ranque-Hilsch Vortex Tube 36
interfacial resistance measurement 303
methane, isotope separation 36
multiparticle systems 39
olefins, nonaromatic determination in petroleum fractions 84
resolutions of deuterated ethanes 200
resolutions of mixtures of CO_2 and N_2O 271
separation speed, gas and liquid 84
Gas
column resolution 119
compressibility factor, nonideal carrier gases 84
determination of argon, oxygen, and nitrogen in air 303
determination of solubility of gases in liquids 465
gaseous diffusion coefficients estimation 302
instrumentation, review 114
mercaptans, determination by 235
methane-propane-silica gel system, retention volume 303
nitrogen oxides separation 304
open tubular columns 271
plant scale 300
pressure-drop effect in columns, theory 384
purified samples by, collection of 271
pyrolysis technique, refinement of 302
retention volume, multicomponent elution gas mixture 303
separations on very long columns 271
simultaneous analysis of mixture of fixed gases and hydrocarbons 303
Teflon tubing, hazards 117
themal oil recovery tests 235
thermodynamic application 88
COAL
additives' effect on flow of 85, 182
carbon black from 449
combustion products, thermodynamic properties, computer program 325
electric power market 52

fuel price competition, coal *vs* oil 1
gas, coal, oil, energy market, growth rate 1
gasoline from 289, 290
gasoline from, prototype unit 363
H-oil hydrogenation process 104
heat content of 201
hydrogen enriched hydrocarbonaceous products from 363
injection in blast furnace, kinetics of 202
jet fuel from 343, 364
liquid fuels from 65, 103
research and technologic work on U. S. Bur. Mines, 1964 445
stock-piling safety precautions 127
sulfur removal, using alkali bath 107
COAL CARBONIZATION
coal properties, Wyo. and Mercer Counties, W. Va. 181
coke and gas from, method 103
entrained bed 182
internal surface determination during 139
moisture content effect, coke ovens 181
olefin yield 65
oven structure for 219
premium fuels from, gas industry, Gt. Brit. 104
steam-fluidized low temperature and cracking of tar vapors 289
tars by low temperature, composition of 219
COAL GASIFICATION
char, hydrogasification, high temperature and pressure 222
char, hydrogasification, kinetics, rapid initial reaction 221
char, hydrogasification, kinetics, second-phase reaction 221
chars, hydrogenation, high temperature and pressure 405
chars, hydrogenation of to methane 104
hydrogasification, pipeline gas from, process 325
hydrogasification of, pipeline gas from 290
Indian, Koppers Totzek type suspension plant 405
Lurgi plant, Coleshill, Gt. Brit. 449
Lurgi plant, Coleshill, supergrid for 407
Ruhrgas slagging gasifier, discontinue experiments with by Nat. Coal Bd. 390
Rummel double shaft slag bath gasifier 257
under pressure, Dorsten plant 140
volatilization of silica in 289
COAL PIPELINES
corrosion reduction by Cr 81
slurries 92
COATINGS
applying machine 375
asphalt, developments 462
atmospheric control, combined Base-metal, metallic-coating systems 35
bacteria deterioration of, tests for 466
ceramic, for gas turbine combustion chambers 300
conductance determination 152
electrostatic 80
hydrocarbon resin based 462
interior for cold storage 80
lining tank bottoms 81
metallic 231
paint research, Intern. Paints, Ltd., Gt. Brit. 462
parylene, condenser tubes 419
Penton-chlorinated polyether 462
pipelines, corona breakdown as factor in jeeping coatings 358
plastic, drill pipe, corrosion costs reduction 419
plastic, LP-gas line, Alleghenies, Pa. 17
plastic, underground steel pipes 269
pipe 35
polyethylene, steel pipe, self-sealing 152
portable pipe, plant 231
protective, research 337
protective, surface preparation 117
protective, types 116
protective for buried pipe 231
research center, F. W. Berk and Co., Ltd., Harlow, Gt. Brit. 462
resins, vinyl solution coatings, physical and chemical properties 375
selection, bacterial activity in 376
silicon-phenolic resins use in heat transfer equipment 232
silicones, Pyrobond 301
structural steelwork 231
tank bottoms, fiber-glass reinforced polyester 152
tanks, precoating of 151
turbine parts 152
underwater curing epoxies, adhesion testing 376
urethanes, foamed 376
vinyl, embossed, outerwrap, advantages 151
vinyl plastic on steel 295
water sealed gasholders 376
yard, method 232
zinc dust-sodium silicate, use in Australia 196
COKE OVEN GAS
plant, Zollverein, Essen 325
COMBUSTION
catalytic, ethylene on CuO, effect of catalyst preparation 405
characteristics, control of town gas 415
coal, products, thermodynamic properties, computer program 325
controlled, nitrogen oxides and hydrocarbons produced 369
heavy fuel oil, residue analysis 235
multiparticle systems 39
submerged, theory and applications 72, 110, 263
submerged for water plants 296
uncontrolled, in dual fuel engine, analysis 86
COMMUNICATIONS
automatic and remote control, high pressure pipeline, North Wales 402
correcting channel failures 285
data for automation, ways of transmitting 441
microwave equipment 192
microwave system, factors 251
microwave system, Petroleos Mexicano pipeline system 356
radio, LP-gas distribution 59
radio telecommunications network 16
reliability in data systems 356
remote control and telemetering systems, design factors 357
COMPETITION
air conditioning costs 386
air conditioning, gas *vs.* electricity 385
curing tobacco, fuel oil *vs.* LP-gas, costs 241
electric heating, condominium, Sea Bright, N. J. 309
electric heating, conversion to, statistics 275
electric heating, economics 314
electric heating, high schools 310 (2)
electric heating, installations 385
electric heating, nonresidential market 241
electric heating and cooling, office bldg., John Hancock Center, Chicago 343
electric *vs.* gas heating and cooling, hospital 343
electric *vs.* gas heating, cooling, multiroom buildings 310
electric *vs.* gas heating, high school, Shingle Creek, Mo. 427
electric *vs.* gas heating, school, Minn. 205
energy market, gas, coal, oil 1 (2)
fuel, oil *vs.* gas, Europe 309
fuel prices, coal *vs.* oil 1
fuel self-sufficiency, gas *vs.* oil Australia 1
fuels for electric power 52
furnace, fuel cost, gas *vs.* oil 386
gas furnace converted to oil 385
greenhouses, oil *vs.* gas 343
heating by light 45
heating by light, high school, Wis. 56
househeating market statistics 241
LP-gas, investment sales, 3 yrs tabulations 2
oil heating, apartments, Riverview Towers 275
oil heating, projects, costs 275
oil water heater market 427
petrochemicals, overseas market 50
petroleum *vs.* nuclear energy 245
vinyl manufacture, PVC *vs.* VCM 377
COMPRESSIBILITY
factors, study 380
turbulence intensification, chemical heat release 37
COMPRESSOR STATIONS
automated 107
automatic control trends 174
centrifugal compressor, surge prevention 15
compressor unit, 12,500 hp 60
compressor units, Pacific Lighting Gas Supply Co., Needles, Calif. 98
construction, unit skid-mounting and prefabrication 175, 400
construction costs, U.S., 1964 216
design, role of gas velocity 107
design trends, survey 441
Hassi R'Mel-Arzew 174, 214
instrumentation, compressors, remote stations 16
Kosciusko, modernization 16
load torque measurement methods 402
maintenance 136
planning and costs 60
remote control and telemetering systems, design factors 357
remote control, Pacific Lighting Gas,

Calif. 442
remote control, Texas Eastern Transmission Corp. 174
Trans-Canada pipeline 174, 215
turbine-compressor unit 174
COMPRESSORS
air efficiency 60
aircraft gas turbine-compressor package, test 252
ammonia, gas engine driven, milk processing plant 332
applications 266
ballistic piston 194
centrifugal, inter-cooled design 415
combination power unit, portable 149
deep drawing shells for 225
defective value detection 78
electronic trouble-shooter analyzer-detector 420
engine compressors, operation, in Far North 16
engine driven, packaged units, offshore installations 356
fluid pressure vibration detector 77
gas engine-reciprocating compressor team 214
gas units, load control, torque measurement 372
heat recovery from 122
packaged gas processing plant 251
performance analyzer 298
preventive maintenance 77
reciprocating, pulse vibrations in piping, computer analysis 400
remote operation of 59
wheel mounted unit 98
COMPUTERS
air conditioning system design 461
analysis of pulse vibrations in reciprocating-compressor piping 400
analytical curves resolution 464
analyzing pressure-flow in gas gathering systems 185
applications in gas utilities 275
catalyst specifications, process design 268
coal combustion products, thermadynamic properties, program 325
company control by 244
control of flowmeters 150
control of liquid pipeline pump station 213
control systems 333
dispatching system 214
distribution system design by 407
environmental control in bldg. 372
exploration use 352, 397
feasibility studies of gas total energy systems 193, 296, 334
fluid flow, solutions of laminar boundary layer equations 202
insulated pipelines design 401
low cost for geophysics use 125
management use, survey 430
oil well production, control of 216
on-line, data processing 343
on-line control for blast furnace 145
pipeline applications 441
pipeline control system, precondition mode 214
pipeline system optimization 251
process control 335, 460
pilot plants, automation 297
program, gas viscosity 426
program, pipeline network 359
program, prediction of physical properties of gases and gas mixtures 307
programming, do it yourself 125
programs, North, Ont. Natural Gas Co. 461
refinery control 460, 461
CONDENSATE
Canvey Island, evaporators, construction 13
crude-condensate, transmission system 18
depletion-performance correlations 284
gasoline plants, portable 250
mixtures, adsorption 58
refining plant, gasoline production 259
CONDENSERS
continuous onstream cleaning method 373
fuel cell, operating stability of 371
high pressure air-fin ammonia 371
refrigerant, sizing of 371
stainless steel tubing 416
tubes, parylene coating 419
CONTROL SYSTEMS
analyzing proportional fluid amplifier circuits 338
bioengineering uses in 229
computers, system design 333
energy conversion, axial dispersion in helical tubes 34
engine compressors, operation in Far North 16
fluid amplifiers 148
fusion control, experimental methods 9
instrumentation, compressors, remote stations 16
on-line instrumentation and evaluation 416
radio telecommunications network 16
steel tempering 30
CONTROLLED ATMOSPHERES
apple storage 329
generation, review 296
heating, intake air 28
load estimation, evaluation of for industrial climate control 127
maintenance of generator equipment 334
makeup air 28
COOLING TOWERS
chromate recovery 77
dry system 149
fans, reinforced plastic blades 149
materials for 416
performance improvement methods 333
problems, nomograph solution 149
CORROSION
atmospheric control, combined Base-metal, metallic-coating systems 35
bacteria, coating selection based on nutritive value 376
corrosive systems, pressure change study by pressure transducer 81
detection device, electrical probe 150
exchanger tubes, naphthalene production 462
ferrous alloys 336
gas turbines by contaminated JP-5 fuel 376
high voltage d-c transmission, effect on buried pipelines 300, 314, 419
hydrogen embrittlement of steel 301
hydrogen plant, causes 269
material resistance, data evaluation 81
pipe inspection techniques, developments in 466
plastic piping by town gas 196 (2)
soil resistivity data, Natl. Bur. Stds. 196
sour gas on equipment, field test 116
sour gas on pipeline equipment 98
stainless steel reformer tubes, oxidation of by butane-steam mixtures 196
steam injection systems 439
steel, stress corrosion of 82
steel by water or salt solutions, measurement 421
steel resistance, methods review 35
surface measurement and inspection instruments, review 465
surface study by low energy diffraction 304
testing, instrumentation in 465
training aids 82
tube and pipe alloys by polluted sea water 152
valves 270
CORROSION CONTROL
action of adsorptive inhibitors 301
asbestos-reinforced plastic pipe 464
austenitic cast iron use in chemical plants 197
austenitic stainless steels, resistance 337
career fields, instruction 344
ceramic materials 463
coal pipelines, Cr use 81
condensors of hydrodesulfurizers 153
corrosion rate meter, use in waterflood system 152
engineers, tasks 463
by explosion cladding 270
gas engine exhausts, corrosive gas removal, Wel-gas process 97
gas plants, economics of 116
guidelines, Nat. Bur. Stds., underground Fe pipeline 419
at high temperatures, Pitan stainless steel system 463
hydrogen plant 232, 269
inhibitor efficiency test 232
mains, test stations 81
maintenance, statistics use 301 (2)
materials selection 35
measures, economic evaluation 269
metals, by design 35
non-destructive testing use, economics of 197
offshore structures 463
by paints 302
pipeline in soil conducting high voltage d-c power 269
plastic coated drill pipe 419
plastic coating of underground steel pipes 269
plastics categories of corrosion resistance 116
plastics Synvarac, usage 269
polyester resins, classes 419
preventive maintenance 35
reinforced plastic 116
stainless steel 116
steel, resistance to atmospheric corrosion 117
steel by bactericidal agent 463

stress-corrosion cracking by cathodic protection 418
tank lining with reinforced glass 197
underground piping system 462
use of o-ring gaskets 154
use of titanium in chemical process equipment 233
water sealed gasholders 376
well tubing, inhibitor squeeze technique 81
COST ACCOUNTING
analysis, capital projects 277
capital cost estimating, chemical industry 386
coking plant costs 161
computer applications in gas utilities 275
construction jobs, method 428
customer billing, data processing equipment use 241
demand-commodity rate, price 99
distribution costs, reduction 346
drilling, cost reduction, equipment upgrading 2
economic analysis, investment return 310
FPC National Power Survey, cost reduction 3
gas and oil exploration and production costs 89
gas industry, expenditure, revenues, survey 1962-1964, Gt. Brit. 4
gas plant economics 312, 427
Lacq gas field, economic problems resulting from 386
little big inch extension, gas in Northwest, costs 20
LNG plants 386
load analysis, forecasting by computer programs, North. Ont. Natural Gas Co. 461
maintenance cost information, EDP application 125
natural gas, well head price 89
oil absorption gas processing plant 355
pipeline projects, investment 387
process instruments maintenance, costs 373
projects appraisal, petroleum and chemical ind., cost and revenue elements 91
strip-chart integrator, readings for, billings, quality control 418
utility, cost analysis, classification 2
weed control, flaming cotton 29
CRYOGENIC STORAGE
ammonia, anhydrous, plant, Calif. 402
ammonia, anhydrous, 9-story tank, La. 446
ammonia anhydrous, tank, method of construction 360
container, method of construction 21, 100, 360
container support and fluid conduit structure 446
containers, nonmetallic 360
containers, epoxy-reinforced glass filament wound 217
frozen-earth method, Conch Intern. Methane Ltd. 362
glass-reinforced plastics, filament wound 179
ground reservoir, liquefied gases, Conch Intern. Methane Ltd. 21
insulation, multilayer 322
insulation, vapor barrier materials 82
insulation systems, liquid H_2 fuel 138
liquefied gases, transport and, review 323
liquid helium container 137
liquid H_2 propellant tanks, use of fiber-glass reinforced 447
LNG tank, above ground 21, 178, 217, 361
LNG tank, below ground 361
LP-gas, safety practices 254
LP-gas terminal, Felixstone, Gt. Brit. 179, 218, 255, 323
LP-gas terminal, Immingham, Gt. Brit. 287
metals for, review 217
method of controlling vapor pressure in enclosed tank 446
mobile Dewar assembly for transport 101
self-discharging tank 63
solar reflectors, storage vessels, cryogenic propellants in space 19
steel vessels for liquefied ethylene 137
strengths of single-layer and multilayer scale model tanks, stainless steel 447
tanks, API standard 137
tanks, liquefied gas removal from 102
tanks, 9% nickel steel, Gaz de France liquid methane project 101
tanks on tanker, Jules Verne 101, 179
CRYOGENICS
boltless attachment and sealing method 361
butterfly valves 287
cooling of liquids by noncondensible gas injection 287
cryoscopic liquid level detector 229
cryosorption pumping 217, 445
gas processing 254
impact testing of Al alloys 217
instrumentation survey 445
Japan, research 178
level indicator for cryogenic liquids 216
liquefied gas transferring system, vaporizor 324
liquid H_2, evaporation 19
metal testing, low temperatures 19
processing improvements 178
pumps, high pressure 335
pumps, industrial 137
refrigeration systems 360
repair of systems containing cryogenic fluids 216
solar reflectors for storage vessels, cryogenic propellants in space 19
superconductivity, second sound, research 18
transfer lines, pressure surge in 446
turbine-type flowmeters 333
vacuum pumps 360
valves 195
CUSTOMER SERVICE
billing, use of data processing 241
equipment selection, personnel training 2
utility, cost analysis, classification 2

D

DATA PROCESSING
chemical sampling, data filter 34
computer applications in gas utilities 275
computer controlled 343
customer billing use 241
EDP application to maintenance cost 125
feasibility studies, management's role in 277
gas works service installations, magnetic tape records 186
refinery, optimum operation, computer use 5
DEHYDRATION
cyclic method, removing component from wet gas stream 440
desiccant regeneration 440
gas mixtures 66
gases, granular desiccant bed method 355
gases, molecular sieves filtering 24, 66
gycol-gas separator 284
natural gas 58, 66
by refrigeration, Maelor gas plant, Gt. Brit. 440
DESALINATION
economics, combination with electric power generating plants 432
flash evaporator plant, Virgin Islands 391
nuclear, advance-gas-cooled reactor 432
nuclear, U.S. state and government plans 9
power and water desalting plant, Calif. 432
power and water desalting with closed-cycle gas turbines 127
reverse osmosis unit, brackish water, Coaling, Calif. 351
sea water, distillation advances 316
sea water, by freezing 129. 209
sea water, by distillation 350
sea water, nuclear method 247
DIELECTRIC CONSTANTS
non-polar gases, formulas 339
DIESEL ENGINES
alternator set, Isle of Grain reforming plant, Gt. Brit. 413
DIFFUSION
absorbing gas rate in non-Newtonian liquids 236
age distribution, open systems, 1963-mid 1964 41
analytical model 36
binary gas system in fine capillary, equations 380
binary molecular coefficients of gases, measurement 236
coefficient, liquid n-alkane mixtures 306
effect on oxidation of nuclear graphite 123
gas separations, permeable membrane 23
multicomponent, flux equations analysis 305
permeation processes, review 134
rate, binary gas mixture thru porous solid catalysts 236, 380
rate through porous catalysts 380
self-diffusion coefficient of CO_2 423

self-diffusivities for gaseous and liquid states, analysis 308
DIPOLES
magnetic susceptibility, imperfect gas 38
DISTILLATION
alcohol, performance simulations 32
azeotropic, recovery of dimethylnaphthalenes from cracked gas oil 212
column performance, feed forward control 332
control, degrees-of-freedom system 306
packed columns applications 415
partial molal enthalpy, methanol, acetone, water component vaporization from 3 component system 38
side stream separation estimation process 285
simulation of steady state behavior of multi-component, H_2, N_2 and CH_4 multifeed reboiled-absorber 271
DISTRIBUTION SYSTEMS
aerial, plastic pipe use in 186
Anchorage, Alaska, earthquake damage 328
Belgium 185
cathodic protection, low output rectifiers for 269
computer, determination of economic pipe diameters in networks 143
computers, analyzing pressure-flow in gas gathering systems 185
construction, big-in. line, Park Ridge, Ill. 408
contract construction, advantages 291
control of high pressure 372
cost comparison, plastic *vs.* steel, Milwaukee Gas Light Co. 260
damage to by unknowing contractors 408
design, computer use in 407
design, using plastic pipes 259
development and present status, U.S.S.R. 143
dispatching systems, operating safety improvement measures, France 134
distribution contractors, gas sales 25
emergency measures, floods, Mo. 291
gas laws, concepts 85
gas pipeline serves oil field in Los Angeles 260
high pressure gas, domestic use 27 (2)
house piping, 2 psig 291
injectors for distribution of propane-air mixtures, France 142
interstate system, Texas and Fla. 49
line repair or replacement, economic analysis 409
meter connects, survey 143
Methane Grid control, Canvey Island 18
Netherlands, gas line completion 25
network analysis by computer 408
offffshore mooring, supertankers 25
oil products terminal 186
pavement removal, plasma torch 69
plastic coated steel tubing, X-Trube, Ala. 78
plastic pipe advantages 261
plastic *vs.* steel, installation and maintenance costs 260
pressure regulators 366
radio telecommunications network, Ont. 16
relocation because of highway, Pittsburgh 260
service installation, magnetic tape records 186
socket-welded pipe design 377
supergrid, dust problems from gas produced by high pressure gasification plant, Coleshill, Gt. Brit. 97
supergrid, from West Midland's high pressure gasification plant, Coleshill, Gt. Brit. 291, 328, 407
types of supply mains, area gas boards, Gt. Brit. 407
urethane foam use 376
DRILLING
with aerated formation water 171
Anadarko basin, Okla. 56
asbestos in drill water, cost savings 395
Australia, activity, 1964, discoveries, development 6
Australia, well completions 397
Australia, Western successes 11
barge, construction, Ocean Prince 6 (2)
big hole, drilling, pre-Cambrian rocks, Canada 11
bit cleaning 317
casing damage by gum perforators 281
collapsed casing repair, U.S.A.E.C. 396
companies share of market, statistics 248
concessions, world's oil industry, North Sea 12
contract rigs, use 281
cost reduction, equipment upgrading 2
cost reduction, factors 436
cost reduction, pipe grading system 6
crooked hole control 209
damage by hurricane Betsy 435
deep well, high temperatures 56
diamond bits 212, 317
directional tool, dyna-drill 396
drag bits 168
drill-stem, fatigue strength 354
drill-stem system 284
drill-tem testing, H_2S control 278
exploratory, statistics, 1964 346
fluids, composition of 435
hydrocarbons, production, Cambrian rocks, wellhead prices 11
large diameter emplacement holes, U.S.A.E.C. 396
in Los Angeles 169
mud removal agents 398
packed hole drill collar 317
packed hole tool 320
pipe, plastic coated, corrosion costs reduction 419
rock types in oil fields 56
rotary, costs 247
silica gel plugging agent 56
square drill collars, costs 248, 282
success ratios, historical average unreliable 126
turbo-drill, British design 212
turbo-drill, Whittle 168, 212, 351
well analysis, Drilloscope 209
world statistics, 1965 389
world's deepest producer, West Tex. 351
Air
aerated drilling fluids 317
Australia, Amadeus basin 352 (2)
deep well experience, Europe 436
percussion, field results 130
problems, solution of 281
tools, adding single joints of pipe to drilling string 396
water monitor 282
Mud
cost of mud pump hp 436
low silt mud for better drilling 130
use in big-hole drilling 130
Offshore
equipment selection 283
France, Southwest Area 211
Louisiana 399
Nigeria 388
North Sea *see* **NORTH SEA**
platform investment 248
world, growth 283
DRILLING PLATFORMS
barge, winter operation, Netherlands 47
cable in Gulf of Mexico off La. 319
corrosion protection methods 463
Hustler, Gulf of Mexico 353, 435
Jubilee, Offshore Co. 436
La., offshore pipeline 353
nuclear generator in 350
offshore, investment 248
offshore equipment 267
prefabricated, South La., South Chauvin field 212
semi-submersible 210, 438
steel platform specifications 96
survey, activities and companies, Europe 250
Swampmaster Mark I unit 95
Tex. coast, Buccaneer project, Shell 438
twin-screw catamaran and Mr. Jack 283
DRILLING RIGS
all electric 317
API rig-rating book 133
contract, use of 281
diesel electric 95, 132
diesel powered 351
hydraulic 396
hydraulic program design 194
instrumentation survey 439
offshore, design, wave spectra use 283
offshore, twin-screw catamaran and Mr. Jack 283
one-level design 317
rotary rig census, U.S., Canada 436
SEDCO 135, La. 283
tools, developments 439
DRILLING VESSELS
dynamically positioned core ship 247
ship, anchor tension measuring device 210
ship, steam rig, Glomar Sirte 130
DRYING
crops by L-P gas 226
gas dryers in printing plant, Gt. Brit. 110, 329
gas oven, Talon zipper plant 329
industrial process by LP-gas 331
processes, mechanics of 265
tubes, for panel sections, oven 112

E

EDUCATION
air conditioning and heating classes, mfg. co. 387
automation, engineer's training 2
automation, social implications 3
chemical, small *vs.* large colleges 275
correspondence course, pipeliners 344
corrosion career fields 344
corrosion training 82
distribution training center, Scotland 311
electric heat competition course, A.G.A. 310
engineering, professional significance 125
examiners, judges, qualifications, duties 5
instrumentation, education 33
physical chemistry in engineering curriculum 205
practice, safety record, Shell 6
programmed instruction, gas industry 276, 387
programmed instruction in industry 3
programmed instruction, multicraft mechanics 45

ELECTRIC POWER GENERATION
aircraft gas turbines for peak load 146
closed cycle gas turbines for 127, 188, 189
costs, steam station cost survey 432, 433
dual-fuel package peaking unit for peak load, costs, reductions 228
gas and steam turbines, peaking needs 330
gas turbine use in plant 227
gas turbines for peak load, costs 455
high temperature alloys for increased efficiency 419
hydroelectric plant, Luxembourg 89
plant, coal-fired, Pa. 89
plant, combined cycle 55
plant, portable 53
projects 392
total power, Rance Estuary Project 11
turbomachinery in space 52
West Pakistan, Sui Gas 432

ELECTRICITY
fossil fuel and energy, market competition 1
high-voltage d-c power transmission projects 314
microwave power transmission 314
Pacific intertie 310
power survey, cost reduction 3
power transmission, wireless, research 8
survey, utilities, EHV plans 432

ELECTROCHEMISTRY
atmospheric control, combined Base-metal, metallic-coating systems 35
cell 113

ENERGY CONSUMPTION
automatic meter reading, test results 26
common market, Europe 315
energy supply, Europe 1965 315
fuel oil *vs.* gas, Europe 309
gas consumption forecasts, energy market, percentile 4
Gt. Brit. fuel supplies, government policy 428, 429
Gt. Brit., Jan.-June, 1964-65 433
natural gas, energy market, position Western Europe 12
natural gas, 1980 91
oil and gas, world 278
petroleum demand, U.S. 1965 forecast 128
structure in West Germany 93
U.S. oil projection, Dept. of Labor 95
world, 1985 348, 433
world fuel and power resources, needs, conferences 392

ENERGY CONVERSION
axial dispersion in helical tubes 34
continuous gas concentration cell 279
degree of coupling and efficiency of 392
fuel production, utilization, economic relationship 7
power transmission, wireless, research 8
SNAP devices (Systems for Nuclear Auxiliary Power) electrical power by 434
thermodynamic concepts, Braytan-cycle power conversion systems 384

ENERGY SOURCES
coal, electric fuel market 52
electron bombardment heating 51
exploration, drilling development, problems 8
fuel production, utilization, economic relationship 7
heat recovery, methane, steam-reforming, H_2 production 7
mechanical energy from gasifying liquefied gas 348
power transmission, wireless, research 8
production, expansion, U.S., abroad, accounts 5
shale oil production 10
U.S. energy balances 46
world energy demand up to 1985 433

ENTHALPY
changes upon vaporization in n-butane-n-decane system 339
partial molal enthalpy, methanol, acetone, water component vaporization from 3 component system 38
propane-benzene system, isothermal pressure effect on 380

ENTROPY
of fusion of polyatomic molecules 200
heat conduction 41

EQUATION OF STATE
comparison of common equations 157
multipolar gases 272
partition function, imperfect gases 38

EQUILIBRIA
adsorption, binary gas mixtures 272
chemical, computation 38
ethane-n-pentane-n-heptane, critical temperatures and pressures 273
magnetic susceptibility, imperfect gas 38
methane-free binary hydrocarbon mixtures, k-constants correlations 423
multicomponent, Wilson equation 236
phase, nonideal liquid mixtures at low temps. 446
scrambling reactions, molecular distribution NMR spectra 88
vapor-liquid, methane-n-hexane-nitrogen system 467
vapor-liquid, ethane-n-heptane system 339
volatile gases in hydrocarbon, cryogenic temperatures 43

ETHANE
alkanes, mass spectrometric, high pressure 38
catalytic hydrogenolysis of, to methane 64
catalytic hydrogenolysis of, Co catalyst 423
decomposition of, effect of lime 449
deuteroethane, electron diffraction study 120
electron diffraction study 120
engine fuel use 165
excitation of by low energy electron beams 87
n-heptane system, critical temperatures and pressures 382
n-heptane system, vapor-liquid equilibria 339
photochlorination of, oxygen effect in 423
photolysis of 380
photolysis, vacuum-ultraviolet 203
proton spin-lattice relaxation time at ice point 306
pyrolysis, kinetics 380
radiolysis, additives effect 203
radiolysis, density effect 203
rate of dissociation 120
thermal decomposition, kinetic and mechanism 85
viscosity 426

ETHYLENE
by-product light oil, Unifining-Udex process for, cost, yields, Japan 404
catalytic combustion on CuO, effect of catalyst preparation 405
catalytic oxidation to olefin oxides 406
decomposition of, effect of lime 449
dimerization of, new catalyst system, low temp. process 102
drying, molecular sieves filtering 24
electrical conductivity, zinc oxides, ethylene hydrogenation 22
excitation of by low energy electron beams 87
flammability characteristics 381
hydrogenation on Ni 220
hydrogenation on Ni, influence of catalyst particle size 363
liquefied, storage in steel vessels 137
mass spectrometric analysis 124
oxidation of, oxides of Co and Cr activity in 423
plant, mass flowmeter use 459
plant, Shell's Cycle refinery in Australia 220
plant, water treatment 239
plants, process for trimming heat needs 363
polymerization, CrO, catalysts 220
polymerization tert-butylperoxy isopropyl carbonate 22
and propylene, cryogenic recovery 14

purification, low temperature 102
radiolysis of 160, 203
radiolysis of, identification of ionic intermediates and formation of excited species by use of electrostatic fields 469
reaction of tritium atoms with 204
recovery, low temperature 14, 65, 66
recovery from gaseous mixture, method 362
structure, electron diffraction study 237
transition-metal catalysts, π-bonded intermediates, hydrocarbon reactions 22
ultraviolet spectra, single and triplet transition, Woodward's rules 237
world capacity 405

Production

by coal carbonization 65
engineering developments, costs 405
Wulff unit, Europe 206

EVAPORATION

electron-beam welding, penetration capacity 18
evaporators, design, Canvey Island methane Terminal 13, 178
hydrogen liquid 19
vapor pressure, measurement, 10^{-5} to 10^{-1} Torr 37

EXPANDERS

turbo, increase process plant efficiency 336, 374

EXPLORATION

Afghanistan oil prospects 437
Alaska, geophysical operations 131
Alaska, Kenai Peninsula 248, 352
Appalachian anticlines, Pa., W. Va. 396
Appalachian basin, N.Y. 399
Australia, activity 387
Australia, Amadeus and Officer Basins 249
Australia, Amadeus Basin 131, 169, 282
Australia, Gidgealpa gas field 169
Australia, Western 283
Australia, Western successes, program report 11
Calif., McKittrick field 249
Canada, oil, Mitsue field 248
by computer 352
computer use in evaluation 397
and drilling development, problems, U.S. 8
fluid mechanics use 397
France, gas field, Meillon, SNPA 317
gravitational technique, Bouguer map 397
Israel, Jurassic oil deposits 131
Libya, oil co. bids 352
magnetic-tellaric prospecting 397
Netherlands, French claim, Ijsselmeer field 205
Netherlands, Friesland Province 397
Netherlands, Moord Holland Province 210
Nevada, oil and gas 282
North Dakota, oil 282
oil and gas costs 89
oil, Bur. Mines fingerprinting brines method 437
oil, car batteries use in 437
oil, fluid mechanics use 169, 249
oil, microorganisms use in 394
oil, Mississippi 210
oil, Telluric currents, geological data 8
Powder River basin, Pa. 352
seismic, common-depth-point technique 397
seismic profiling, Laser Scan 169
Spain 249
Switzerland, gas and oil 318
Thailand, oil, Fang basin 248
West Germany, oil and gas 282

Offshore

Australia, gas 282
Australia, gas and oil 319
Australia, Gippsland coast 57, 438
Brazil prospects 398
Canada, oil and gas 282
continental shelves, prospects 282
Gt. Brit. coastal tract sales 398
high frequency sound pulser, map sea floor 398
Louisiana 399
Newfoundland, Grand Bank 210
Nigeria 388
North Sea, see **NORTH SEA**
propane-based gas exploder technique 318
search activities 318
Texas, Bucaaner area, gas sale 165, 206
world activity 250

EXPLOSIONS

explosibility data for carbonaceous dusts 127
explosive research, U.S. Bur. Mines, 1963 127
nuclear, hydrocarbon reservoir stimulation 394
nuclear, oil from oil shale 394
nuclear, radioactive contamination, petroleum reservoir stimulation 394
Tenn. Gas Pipeline Co. pipeline, cause of high pressure line failure 244, 278
urea-ammonium nitrate solutions 51

F

FEDERAL POWER COMMISSION

area rate cases 46
gas pipeline projects, Southern Calif. 242, 310
gas prices, Permian basin 3, 90, 311, 387
gas reserves, sales control 3
lower ceiling prices, southern La. 428
National Power Survey, cost reduction 3
natural gas, wellhead price cost 89, 397
Natural Gas Act, ammendments 125
natural gas act experience 344
natural gas regulation, reform 89
price ceiling, competition *vs.* regulation 311
price hearings, Hugoton-Anadarko, Texas Gulf Coast 3
Rayne case decision 241

FERTILIZERS

ammonia plant, midwest expansion 21
European markets 46
plant, Canada, Sarnia's Chemical Valley 347
plant, Gt. Brit., Shellstar Ltd. 311
plant, Iowa, Terra Chemical Intern. 404
plant, Nipak Inc. in Kerens, Tex. 259
plant, Philippines, Esso 363
production Mexico, new plants construction 311
production, Romania 311
sales, Canada 162
U.S. investment abroad 276

FISCHER-TROPSCH SYNTHESIS

sulfur poisoning of iron catalysts, U.S. Bur. Mines 103

FLAME CULTIVATION

LP-gas, research 145, 226
weed control, flaming cotton 29
weevil control, U.S. Dept. Agric. research 329

FLAME RESEARCH

bray jets, hydrocarbon-rich gases 29
flame and furnace configuration 111
flame characteristics, interchangeability of synthetic gases with natural gas 294
U.S. Bur. Mines, 1963 127

FLOWMETERS

apparatus 365
calibration, large scale 416
electromagnetic controlled by computer 150
fibre, laminar flow rates in a tube 459
fluorometer, dye spot, interfaces 416
induced magnetic field type 267
laser anemometer 150
mass, accuracy of 26
mass, ethylene measurement by 459
mass flow measuring device 77
turbine, pulsation errors in 229
turbine-type, cryogenic service 333
types for large volume gas measurement 193
ultrasonic 333

FLUID FLOW

analytical model, two-phase critical flow rate 121
bubble velocities in stagnant liquids 424
conducting acceleration by a traveling magnetic field 467
countercurrent gas-liquid flow 201
dynamics, computer experiments in theory of 121
effect of bouyant forces on laminar flow 157
effect of process variables 381
effect of temperature on low pressure gas flow 159
Fanning equation 201
flat-plate helical inducer, cavitation studies 34
flow of gas in channels in presence of heat transfer 424
gas flow in mains, different diameters in series and parallel 453
gas flow in resin coated pipelines 445
gas flow pattern in cyclone cylinders 382
high velocity, effect on static and dynamic characteristics of pipe 321
laminar boundary layer flow, compressible, computer use in solving 202
magnetohydrodynamic flow in rectangular ducts 237
measurement of skin friction in turbulent boundary layer, calibration of Prestor tube 467
nonequilibrium expanding flows, study 88
nonsteady two-phase flow 39

one-dimensional flow in an ionizing gas 467
orifice flow 33
prediction of voidage in vertical gas-liquid flow 424
single and multiphase systems problem solution, review 306
stability of horizontal liquid layer with change in vertical temperature gradient 157
stability of two-fluid wheel flows 381
superconductivity, second sound, research 18
transient gas flow in pipelines 60
two-phase annular, flow mechanism in 423
two-phase flow, gas gathering system 25
unsteady viscous vortex toward center, analysis 424
velocity fields and turbulence in tubes 60
vertical flow, two fluid phases 121

FLUIDIZED BEDS

gas, solid thermal properties, effect on heat transfer to 40
heat transfer from wall to, model 424
hydrodynamic stability of 121
mathematical model of 201
minimum fluidization velocity, prediction expression 381
mixing powdered materials in 65
packed, heat transfer in 238
particle-to-gas, in fluidized beds 41
plant operation, Fluostatic dryers 66
plasma, reaction of solids, commercial scale 42
tapered 299

FOREIGN ACTIVITIES

pipeline facilities, world 48
U.S. chemical co., overseas investment 126

Africa

oil production 161

Algeria

french firm export Hassi R'Mel gas 170
oil and gas agreement with France 344, 428
pipelines to Europe 162

Argentina

oil imports 164
pipeline construction, Gas del Estada, Commodore Rivadaria - Buenos Aires 46, 48

Australia

activity, 1964 report, discoveries, development 6
Alton field, pipeline construction 18
exploration, oil and gas activity 387
exploration, oil and gas Amadeus basin 169
fuel competition, self-sufficiency, gas *vs.* oil, Australia 1
gas discovery, Amadeus basin 131
gas prospects 428
gas reserves, development 47
laboratory, Gas and Fuel Corp. 429
natural gas market, Queensland 344
pipeline, Gidgealpa-Adelaide 99
western exploration successes 11

Belgium

gas from Netherlands 387
gas industry 185
pipeline system, Groningen gas 99

Canada

Alberta, oil, gas and coal reserves 244, 281
Alberta, oil and gas investment 276
Alberta, oil sand project 132
Alberta, petrochemical industry growth 278
big hole drilling, pre-Cambrian rocks, Canada 11
fertilizers, sales 162
gas and oil reserves, 1964 126, 208
gas industry growth 90, 311
gas research, Can. Gas Assoc. 312
gas transmission, reserves, production Northeastern British Columbia 17
large diameter pipe production mill 62
natural gas export 242, 344, 345, 389
natural gas reserves and consumption 242, 344, 345, 489
oil reserves and demand 243
petrochemicals, Chemical Valley growth 347
Trans-Canada proposed pipeline 62

Chile

gas reserves, Magellan area 242

Columbia

petroleum development 283
pipeline construction in jungle area 26

Eastern Europe

natural gas production 162

Europe

common market, energy demand and consumption 315
fertilizer market 46
fuel oil *vs.* gas markets 309
gas research 207
natural gas development 276
natural gas in European Economic Community 243
petrochemicals, competition to U.S. products 50
petroleum research 207

France

Algeria agreement, exploitation of Saharan gas 428
gas output fluctuations study 366
gas plant, Lausanne 126
Lacq gas field, economic problems resulting from 386
natural gas consumption forecasts 388
North Sea gas discovery 47
oil-gas generator 23
petrochemicals growth 91
power station, Rance Estuary Project 11
refinery, Mobil Oil Francaise, Frontignan 68
U.S. industrial investments in 90

Germany

North Sea, gas discoveries, Rotliegendes 10

Great Britain

appliances, sales, East Midland 48
Arzew liquefaction plant 63
barge, construction, Ocean Prince, description, cost 6 (2)
Canvey Island, evaporators, construction 13
coal-to-butane for gas production, Isle of Man 162
developments, East Midlands Gas Bd., Gt. Brit. 451
fertilizer plant 311
fuel supplies, government policy 428, 429
gas imports from Nigeria 345
gas industry, expenditure, revenues, survey 4
gas industry growth 243, 276
importing LNG from Nigeria 90
Methane Grid control, Canvey Island 18
Methane Terminal, Canvey Island 20
Midlands Research Center projects 313
North Eastern Gas Bd., increase gas output 429
oil gasification plant, Bilston 66
oil imports from Libya 206
reforming plant, Meadow Lane 106
reforming plant, I.C.I. process, East Greenwich 106
sales, East Midlands Gas Board, Gt. Brit. 345, 451
Seabank, I.C.I., reformer plant 106
survey temperature and pressure measurement in consumer's premises 365
underground storage bill, Gas Council 102

Hungary

gas industry 162
gas processing plant 345

India

chemical industry growth 276
oil and gas resources, development of 390

Iran

Ahwaz crude, to Tehran 17
offshore exploration 57

Israel

Jurassic oil deposits 131

Italy

Ente Nazionale Idrocarburi 242, 428
gas industry 163
oil and gas production 205
Transalpine pipeline construction 48

Japan

LNG and LP-gas imports 313
natural gas, growth 243
oil industry 206
petroleum demand, investment 163

Libya

gas and oil exporter 389
gas utilization 243
offshore drill test 131
oil exports to Gt. Brit. 206
petroleum development 243
Sirte basin bids 345

Luxembourg

hydroelectric plant 89

Mexico

ammonia pipeline 46
fertilizer production 311

Middle East

natural gas development 126

Netherlands

barge, winter operation 47
French claim, Ijsselmeer field 205, 245
gas line completion 25
Groningen gas, production review 4
Groningen gas reserves, developments, utilization 4
natural gas development 126
North Sea gas for export 162
pipeline construction 47
Royal Dutch Shell, growth 243

New Zealand
Kapuni natural gas utilization report 389
Nigeria
oil and gas development 163
petroleum production 163
Pakistan
gas industry, developments in reserves, transmission and utilization 311
gas reserves uses, report 243
oil and gas resources, development of 390
pipeline bridge construction 62
pipeline system, Sun gas field 389
Sui gas, utilization, in Pakistan 12
Puerto Rico
petrochemicals, growth 90
petrochemicals expansion 311
Scotland
nuclear power station, Hunterston 53
town heating by gas-fired warm air central system, Cumberland 73
Spain
Algerian gas agreement 206
offshore permits, Royal Dutch Shell 132
Turkey
pipeline construction, Turkish Oil Fields to Mediterranean 26
U.S.S.R.
acrylonitrile plant construction 47
air conditioning industry 70
Bukhara-Urals pipeline 135
LP-gas production 58
gas main system, North Causasus-Moscow-Leningrad 135
natural gas production 162, 276
oil and gas production 276
oil field, Fourth Baku 90
oil shale industry 429
pipeline construction projects 61
solar energy use 350
West Germany
energy consumption 93
gas discoveries 48
gas fields in Europe effect on German economy 90
gas from Netherlands 387
gas industry 389
Gasversorgung Nordrhein line 99
natural gas industry 345
Yugoslavia
petrochemicals production 90
FORMALDEHYDE
domestic production 23
FRACTIONATION
column contact devices, selection 297
FRACTURING
deviation control by reflux generators 332
hydraulic, models 353
hydraulic, Pa. 353
nuclear, "gasbuggy" study 318, 319
nuclear, gas fields 211
nuclear, hydrocarbon reservoir stimulation 394
nuclear, radioactive contamination, petroleum reservoir stimulation 394
propping agent spacer effect 439
FREE RADICALS
reactions with phenol vapor 123
water pollution, gamma radiation, sedimentation rate 10
FUEL CELLS
anodically oxidizing hydrocarbons at low temperatures and pressures 392
antipolar ion exchange membrane 315
apparatus 279
apparatus for heat and water removal 245
applications, prospects 433
Bacon-cell 94
bacterial oxidation, methane 64, 128, 394
battery, heat transfer in 468
battery with flat carbon electrodes 349
catalytic, electrode construction 8
cathode catalyst, gold 348
coal 165
condenser, operating stability of 371
control device 315
efficiency, degree of coupling 433
electrochemical reaction apparatus 208, 349
gaseous fuel generator 52
Gemini 5, Genl. Electric models 349
hydrazine 94
hydrocarbon adsorption, galvanostatic, volumetric studies 8
hydrogen anodes, Pt on C catalyst system 128
hydrogen bridge 315
hydrogen concentration cell 208
hydrogen by low-temperature reforming of liquid hydrocarbons 53
hydrogen purification 52
hydrogen recovery 349
liquid fuel, method of operation 349
low-temperature, oxide catalysts, performance of Co in 393
membrane quality control method 156
methanol, electrodes 9
methanol, Esso 128, 208 (2), 280
methanol, Shell 8, 93, 129
method of preventing fuel from migrating across chamber to air electrode 316
models for mode of operation of porous gas diffusion electrodes 341
models for porous gas diffusion electrodes, comparison of 245
molten carbonate electrolyte 393
nontoxic electrolyte 94
oxidation of alkali borohydrides 128
oxygen generation 348
platinum metals in 166, 433
portable power plant 53
primary battery, continuous feed 93
progress review 393
research and developments 349
unitary body, using MgO 52
Electrodes
carbon-metal 279
construction method 279
electrode 279
hydrophobic 245
conditioning 52
hydrocarbon 128
impregnation by colloidal suspension of catalytic material 165
Ni preparation of 93
paper 350
porous Ni, production and properties 129
Teflon 94
for reduction of oxygen in 349
FURNACES
annealing 195
blast, on-line computer control 145
blower and limit controls, principles 294
burner walls 71
carburizing 331
cracking furniaces, computer designed 29
in cutlery, Flashrite burners in refractory tunnel 226
flame pattern 111
gas converted to oil 385
gas *vs.* oil, costs 386
heat transfer from flames 158
heat transfer theory 149
for intermittent combustion 264
for porcelain decorations firing. Haviland 455
for reducing metal oxide 451
reforming hydrocarbons, Kellogg process 404
refractory-lined for research 111
report, Joint Refractories Research Comm., Gt. Brit. 269
rotating cylindrical, iron ore reduction 377
sintering, powdered metal parts plant 75
steel tempering 30
steels heated without decarburization 73
stress-relieving, 82.5 million Btuh 29
vacuum, high temperatures 194

G

GAS ANALYSIS
(see also under specific gases)
apparatus 302
apparatus for detecting water vapor in 338
Argon, anomalous shock velocity measurements by microwave 42
detector cell capacitors, high sensitivity 33
developments 421
dielectric element for measuring thermal conductivity, pressure and velocity of gases 200
fuel gas constituents determination 235
infrared gas analyzer 84
mass spectrometry use 379
null-type transducer for measurement of pressure of corrsive gases 464
sulfur containing gases with GLC ionization detectors 120
thermal conductivity cells 234
by X-ray fluorescence emission spectrometry 157
GAS CLEANING
Anderson Hi-eF purifiers, control flow of entrainment-laden vapor 230
Cottrell precipitators, gas velocity distribution in 237
ejector venturi scrubber, energy and efficiency characteristics 300
electrostatic precipitators, factors effecting size 58
gravel bed filter, Lurgi-MB-filter 97
helical flow Venturi-scrubber with separator combination 285

modified hot-carbonate process, ammonia plant 320
venturi scrubber, sinter plant installation 97
venturi-type gas absorption system, multistaged 355
GAS CONDITIONING
(see also CO_2 Removal, DEHYDRATION, HYDROGEN SULFIDE Removal and SULFUR Removal)
ethylene, propylene, cryogenic recovery 14
nitrogen removal, natural gas, methane recovery 14
sulfinol process, evaluation, acid-removal operations 14
GAS DISCOVERIES
activity, 1964 report, discoveries, development 6
Alaska, Kenai Peninsula 248
Australia 1, 387
Australia, Amadeus basin 131
Australia, Gippsland Shelf 397
France, Meillon 1, SNPA 317
Lacq gas field, economic problems resulting from 386
Netherlands, Friesland Province 397
North Sea, gas discoveries, Rotliegendes, Germany 10
GAS ENGINES
air injection plant, use in 211
applications, when, where and why 372
control, pneumatic circuits 333
craft, propeller blades, reinforced plastic 149
driven ammonia compressors, milk processing plant 332
drives air conditioning system 293
drives air conditioning system, factory 187
drives compressor, air conditioning, department store, Brooklyn 292
driving refrigeration compressors, status report 458
dual fuel, uncontrolled combustion analysis 86
dual fuel carburetion 72
dual fuel diesel, generator set, economies 227
electronic analyzer-detector, piston-ring blowby and cylinder scoring 420
engine-reciprocating compressor team 214
exhausts, corrosive gas removal, wel-gas process 97
greasing of 458
ice rink use 31
internal combustion, alternate fuels for 372
LP-gas engine ethyl tests 31
medium speed 111
natural gas, Cummins Engine Co. 227
natural gas use in dual fuel engine, municipal power plant 167
oil change determination by infrared analysis 298
operation and maintenance determined in design 374
performance analyzer 298
piston engine, power for space vehicle 128
reciprocating, preventive maintenance 298
for ship propulsion 145
snow making machine 75
Stirling hot-air engine 239
total energy installation 74, 76 (2)
total energy system utilization 77
turbocharged 264
turbocharging, constant-pressure 455
usage survey 392
waterflood project use 417
GAS HOLDERS
cylinders produced by pierced billet method 178
dry-seal pressure type 101
electrical anti-freeze installation on 446
H_2S treatment, Panacide process, Gt. Brit. 399
moving of 62
re-siting of 254
stations, automatic, Gt. Brit. 185
Viton gas bag 218
water sealed, maintenance 376
weed control 165
GAS HYDRATES
methane-nitrogen system 272
GAS INDUSTRY FINANCE
economic analysis, investment return 310, 312
expenditure, 1964 49
expenditures, 1966-68 390
gas companies' earnings 1964 244, 429
Great Britain, expenditure and revenue surveys, 1962-64 4
househeating market 241
revenues, 1964 49
GAS INDUSTRY MANAGEMENT
company control by computer 244
computer as a profit-making tool 430
contract demand optimization 86
cost accounting, gas plants 427
critical path planning 374
data processing feasibility studies 277
demand-commodity rate, price 99
distribution line repair or replacement economic analysis 409
economic analysis, investment return 310
economic analysis, R & D projects 277
fuel cell market 349
fuel production, utilization, economic relationship 7
gas industry economics, Gt. Brit. 312
load analysis, forecasting, economics by computer programs, North. Ont. Natural Gas Co. 461
long range forecasting, method 277
market, air pollution control 275
pension plans, Am. Chem. Soc. members 430
pipeline projects, investment 359, 387
process-system engineering use 244
programmed instruction 387
storage needs 402
store performance, measuring and controlling, Pacific Gas Electric Co. 430
success ratio for drilling, historical averages unreliable 126
systems analysis 80
utility, cost analysis, classification 2
GAS INDUSTRY STATISTICS
apartment construction market 314
Canada 90, 345
Canada, 1964, Can. Gas Assoc. 311
conversion to electric heating 275
gas co. financial reports 429
gas distribution, meter connects, survey 143
gas production, U.S., 1964 312
Gt. Brit., expenditure, revenues, survey 1962-64 4
Gt. Brit., Gas Council 243
Gt. Brit., home heating sales 429
househeating customers, A.G.A. survey 312, 345 (2)
househeating market 241
pipeline construction, 1965 62
pipeline construction costs, 1964 216, 253
pipelines, investment and mileage 50
revenues, expenditures, 1964 49
underground storage capacity 324
GAS LAWS
concepts for distribution use 85
GAS MEASUREMENT
automation of 441
energy units, discussion 303
survey, temperature and pressure in domestic consumers' premises, Gt. Brit. 365
GAS MIXTURES
aliphatic hydrocarbons, binary, critical temps, and press. 425
binary, viscosity coefficient, approximation formula 342
dehydration of 66
gas-particle, dynamics, effect of finite particle volume 306
gas separations, permeable membranes 23
highly nonequilibrium boundary-layer flows, multi-component dissociated gas mixture 39
nonpolar, viscosity at moderate and high pressures 384
physical properties prediction by computer program 307
removal of sulfur containing acidic gas from, absorbent process 58
saturator for vapor-gas mixtures 148
thermal conductivity, method 273
vertical flow in small-diameter siphon-type flowstrings 467
GAS PLANTS
Ancona Gas Works, Italy, light petroleum distillate reforming 364
Bilston, Gt. Brit., oil gasification 66
Brighton, Gt. Brit., light petroleum distillates, catalytic rich gas process 452
Bromly, Gt. Brit., O.N.I.A. continuous autocaloric process 15, 23, 451
Cadwell Lane, Hitchins, Gt. Brit., naphtha reforming, I.C.I. process 327 (2), 364
cost accounting 427
Cremorne Lane, Norwich, Gt. Brit., light petroleum distillate reforming, Otto process 327 (2)
Dorsten, coal gasification 140
Dunedin Works, N. Zealand, light

petroleum distillate reforming, P_2 process 66
economics, Gt. Brit. 312
East Greenwich works, Gt. Brit., light petroleum distillate reforming, ICI process 106
E. M. Edwards works, Llandarcy, Wales, petroleum distillate reforming, ICI process 325, 406
Isle of Grain, Gt. Brit., petroleum distillate 326
Isle of Grain, Gt. Brit., prime movers, reforming plant 413
Isle of Man, Gt. Brit., butane for gas manufacture 162
Killingholme plant, light petroleum distillate reforming, ICI process 185
Lausanne, France, oil cracking 126
Maelor gasworks, Gt. Brit., drying plant 440
Meadow Lane, Leeds, light petroleum distillate reforming, ICI process 106, 141
Middlesbrough, Gt. Brit., cyclic catalytic reforming, light petroleum distillate, ICI process 184
Nine Elms gas works, Gt. Brit., Lurgi shift conversion 290
North Western Gas Bd., Gt. Brit., naphtha, reforming, ICI process 429
Obuda works, Hungary, natural gas-air reforming 184
Pavia Gas Works, Italy, SSC process, natural gas catalytic reforming, light petroleum distillate 364
Preston, Gt. Brit., cyclic oil reforming, Stazione Sperimentali Combustibili process 98
Provan gas works, Glasgow, Scotland, light petroleum distillate reforming, ICI process 406, 452
Reading gas works, Gt. Brit., LP-gas and natural gas as feedstocks 172
Rotterdam-Feijenoord Gasworks Joklik-Kuninger-Otto cyclic reforming 142
sampling and testing methods, ICI reforming process 466
Savil Town, Dewsbury, Gt. Brit., catalytic reforming, ICI process 163
Seabank, Avonmouth, Gt. Brit., light petroleum distillate reforming ICI process 291, 452
specifications, hydrocarbon conversion 142
West Hartlepool, Gt. Brit., light petroleum distillate reforming ICI process 406, 452

GAS PROCESSING

brazed aluminum heat exchangers for 32
cryogenic use 254
hydrocarbons, combustible gas, apparatus 25
packaged compressor use 251
quick cycle hydrocarbon recovery units 251
recovery of natural gas liquids, He concentrate, N_2, process 440
safety in 207
simulation of plant operation 182

Plants

absorption oil system maintenance 334
automation of 59
Canada, Edison gas field 388
economics 45
Empress, Alberta, Pacific Petroleums Ltd. 285
Garden City, Humble Oil 97
Hungary 345
molecular sieves dry feed gas, Kenova, W. Va., United Fuel Gas 172
natural gas 259
oil absorption, cost estimating 355
sulfur removal, iron-sponge process 440
when to modernize 440

GAS PRODUCERS

FPC Permian basin decision 90, 387
FPC area rate cases 46
FPC decision, lower ceiling prices, southern La. 428
FPC jurisdiction, Rayne case 241
FPC well head price control 90, 387
gas and oil production costs 89

GAS PRODUCTION

Canada, north eastern British Columbia 17
Dutch gas, production review, Groningen 4
effect of water influx on p/z cumulative production curves 159
exploration, drilling development problems 8
large scale deliveries, offshore gas field, Texas Eastern, Gulf oil 12
mineralogical analysis, Qusseir shales, carbonaceous shales 10

GAS PURIFICATION

absorption of H_2S by sodium arsenite, Giammarco-Vetrocoke unit, Milan gasworks 134
centrifugal separators use, acid treating, removal of trace olefins 213
gas works effluents, catalytic oxidation of phenols 134
hydrocarbons separation and extraction from natural gas pipelines, automatic separation instruments 379
H_2 -CO synthesis gas, absorption of impurities from, use of methanol process 285
H_2S removal, sour gas, monethanolamine degradation prevention 173
Lurgi cold-shaft conversion plant, Partington, Gt. Brit. 453
soluble gas removal from H_2 containing gas-mixtures 355

GAS REGULATION

(see also FEDERAL POWER COMMISSION)

Texas Railroad Commission 127

GAS RESEARCH

A.G.A. projects 164
burners, Midlands Research Station, Solihull 412
clients, contractors and R & D, symposium on 278
cooking appliances, A.G.A. 71
in Europe 207
evaluation of new and different ways to heat the home 295
flame cultivation, LP-gas, U.S. Dept. Agric. 329
fracture resistance in line pipe, A.G.A. 321
fuel cells 349
laboratory, Gas and Fuel Corp., Australia 429
projects, A.G.A. and Can. Gas Assoc. 312
projects, Midlands Research Center, Gt. Brit. 313
prototype appliances, A.G.A. labs 312
refinery, optimum operation, computer use 5
Ruhgas slagging gasifier, discontinue experiments with by Nat. Coal Bd. 390
underground storage, A.G.A. 448
water heaters, positive temperature control 30

GAS RESERVES

Alaska leases, cleared by government 166
Alberta, Canada 244, 281
Alton Field, pipeline construction 18
Anadarko basin, Okla. 56
Australia 47, 428
Canada, 1964 126, 208
Chile, Magellan area 242
gas reserves, sales control 3
gas transmission, reserves, production, Northeastern British Columbia 17
growth, South, La.
Hassi R'Mel field 170
Iranian, Russian import 434
market for new 51
natural gas, energy market, position, Western Europe 12
Netherlands, French claim, Ijsselmeer field 245
Netherlands, Groningen, Gasunie gas line completion 25
Netherlands, Groningen, development, utilization 4
Pakistan, Sui gas, utilization 12, 243
superconductivity, second sound, research 18
U.S., 1964 167
U.S., 1964, A.G.A. study 166, 208
U.S., future supply 280
U.S., future supply, exploration incentives 280
U.S.S.R. 401
Western Europe 434
Wilburton gas field, Okla. 166
world 393

GAS TURBINES

air separation plant use 146
aircraft type, patrol boats 417
aircraft-type-compressor package, test 252
aircraft-type for peak load electric power 146
applications 188
axial-flow, parametric exploration, Rankine cycle space power-plants 16
blade materials need for high temperature 417
closed-cycle for power generation 188, 189
closed-cycle for power generation and water desalination 127
combustion chambers, ceramic coating 300
compressor set, use in peak shaving plant 292
compressor stations 60
corrosion by contaminated JP-5 fuel 376

developments, 1965 98
drive electric generator, power plant 227
dual-fuel package peakage unit, power plant 228
energy recovery, small turbines, cooling 31
exhaust heat recovery boiler system, costs 227
expansion 333
fuel controls for 415
generator package, Caterpillar 455
heat recovery methods 381
hp increase, by air-cooled blades and vanes 413
manufacture of 294
nuclear power use 281
operation and maintenance 374
operation and maintenance experience, total energy system, gas co., Calif. 413
packaged peaking plant 98
packaged turbine generator set 191 (2)
peak load coverage, electric power generation, costs 455
performance, environmental control techniques 227
power for emergency ward unit 228
power plant, combined cycle 55
regenerative cycle, recuperator progress 334
simple-cycle, Westinghouse, 100,000 operating hr 442
steam plant use 188
with steam turbines, power plants, peaking needs 330
supercharging, capability of 295
use in pumping station for crude oil 227

GASES

imperfect magnetic susceptibility, statistical theory of 38
lattice, occupation probabilities in 43
master equation 202
physical properties prediction by computer program 307
polyatomic, vibrational relaxation times 308

GASIFICATION

cellulose as synthesis gas source 223
coal, see COAL GASIFICATION
gas making processes, principles 140
hydrocarbons for gas making, processes 142
hydrocarbons to H_2 and CO 103
light petroleum feedstocks, catalytic 67, 139
liquid hydrocarbons, processes 24, 66, 182, 257
oil-gas generator 23
plant operation, Bilston, Gt. Brit. 66
premium fuels, production 24
slagging, behavior of mineral matter 256
slagging pressure gasifier, experiments 256

GENERATORS

gas, power device operated by 267
-gas turbine package, Caterpillar 455
gaseous for fuel cell 52
oil-gas generator 23
standby, LP-gas, dual fuel carburetion 72
standby, natural gas fuel 72
steam, digital control systems 294

GEOLOGY

Afghanistan, oil prospects 437
Alberta, Can., Late Devonian reefs 249
Alberta, Can., shale composition 57
core resistivity profiles, dipmeter survey interpretation 11
Israel, Jurassic oil deposits 131
Japan, natural gas sources 170
mineralogical analysis, Qusseir shales, carbonaceous shales 10
natural gas and oil origin, theories 95
North Sea basin 249, 437
oil origin theory 437
Ontario, Can., hydrocarbons, production, Cambrian rocks, wellhead prices 11
petroleum evolution, geochemical aspect 211
petroleum exploration, Telluric currents, geological data 8
petroleum origin, geologic aspects 13
Precambrian petroleum 57

GEOTHERMAL ENERGY

Calif. geothermal brine area, Morton Salt 94
harnessing efforts 393

GREENHOUSES

gas-fired unit, environmental control 456
LP-gas use, tomatoes 189
oil *vs.* gas 343
promotion of gas conversion burners for production of CO_2 228

H

HEAT OF COMBUSTION

gases, determination 234

HEAT OF MIXING

alcohol hydrocarbon systems 237
methanol-n-heptane system 237
methanol-n-hexane system 237

HEAT CAPACITY

boilers, effect of heat storage on performance 121
coal, heat content of 201
coal, specific heat 201
gas fluidized beds, solid thermal properties 40
linear high polymers, specific heat 39
natural gas, methods 272

HEAT CONDUCTIVITY

thermokinetic analysis of 41

HEAT EXCHANGERS

air-cooled, testing of 373
brazed aluminum heat exchangers, natural gas processing 32
costs 267
cryogenic for helium extraction 267
design, lower maintenance costs 149
finned, efficiency determination 334
flexible tubes of Teflon 297
flow geometry and performance 297
fouling factor 297
gas-fired hot air unit 229
heat transfer in, theory 149
o-rings use 416
plastic-tube design concept 416
pressure drop studies in plate heater 373
silt setting, prevention 334
spray column, mixing effects in 459
thermal regenerator, simulations, computer 39
types 267

HEAT PUMPS

air source cascade 73
ammonia compressors as, milk processing plant 332
bacterial fouling of, treatment 189
condominum, Fort Lauderdale, Fla. 367
high school, Kimberly, Wis. 73
high school, Wis. 56
water heating by heat recovery from 166

HEAT RECOVERY

costs, gas turbine exhaust heat recovery boiler systems 227
energy losses, reduction of 94
energy recovery, small turbines, cooling 31
equipment, design and installation 418 (2)
gas engines, use of 373
gas engine driven NH_3 compressors to generate evaporator heat, milk processing plant 332
gas turbine, air separation plant 146
from gas turbines, methods 381
from gas turbines for production of water 127
heat reclaimer, gas-fired dryers 29
heat recovery, methane, steam-reforming, H_2 production 7
by hot-gas expanders 55
from incinerators, use 265
magnetohydrodynamic generator 9
refrigeration systems, status report 458
systems 459
total energy systems 76, 247
turbo-expander use 336, 374
waste from compressors 122
waste-heat boilers 55
waste in steam reforming for town gas production, economics 327
water heating by heat pumps 166

HEAT TRANSFER

analysis, annulus with variable circumferential heat flux 40
analysis of thermal energy storage for solar energy conversion systems 381
bibliography, review, 1964 340
binary liquid-vapor system, suddenly pressurized 468
coefficients for confined fluids 122
coefficients, free-jet flow, circular cylinder 41
coefficients, sphere and cylinder to fluidized bed 40
design, for HPI, radiation principles 467
design equation, to fluids 273
dust suspension as medium 339
effect of peripheral wall conduction on laminar forced convection in rectangular channels 122
equipment, use of silicon-phenolic resins coatings 232
from flames in furnace 158
flow of gas in channels in presence of 424
fluidized bed feasible, reacting solids, commercial scale 42
fluidized bed, wall to fluid, model 424
free convection flow from vertical surfaces 158
free-jet flow, circular cylinder, mean

coefficient 41
and freezing front motion outside and infinite, isothermal cylinder 468
to gas containing cloud of particles 468
gas fluidized beds, solid thermal properties 40
highly nonequilibrium boundary-layer flows, multicomponent dissociated gas mixture 39
of inert gases and their binary mixtures 158
in fuel cell battery 468
isothermal flat plate to air steam, pressure gradient and turbulence effects 41
laminar flow in entrance of circular tubes 158
laminar non-Newtonian flow in circular tubes 158
in mixed fuel boilers 75
multiparticle systems 39
in packed fluidized beds 238
particle-to-gas, in fluidized beds 41
pressure and convective, measurements in shock tunnel 424
reaction rate, temperature dependence, NO_2 decomposition 40
research, 1963 to March 1964 40
roughened surfaces 40
solar reflectors, storage vessels, cryogenic propellants in space 19
spiral tube coils, equations 381
system of units, selection for heat computation 122
theory in furnaces and heaters 149
thermal conductance of a wall 158
turbulence intensification, chemical heat release 37
turbulent boundary layer 381
turbulent boundary layer to catalytic surfaces 122
turbulent flow, helically coiled tubes 40
unsteady state, in pipeline 273

HEAT TREATMENT

automatic control of in plant 148
automatic heat-treating, hardening operations 30
controlled gas atmospheres, applications 226, 456
drilling equipment 30
metals, rapid melting techniques, progress, Gas Council, Gt. Brit. 457
metals by induction 118
postweld, effect on deposited weld metal 337
salt-bath methods 118
stress-relieving, 82.5 million Btuh 29

HEATERS

approval standards, Gas Council, Gt. Brit. 413
car wash profits 30
down beam heater 264
gas and electric combination, clothes drier 29
gas burning hot air type 228
gas-fired make up air units, installation of in foundry 295
gas-fired unit, humidity control system, refractories plant 413
heat transfer theory 149
infrared, metal fabricating plant, cost savings 456
LP-gas, car thawing, coal-dock dumping 30
Potterton warm air units, Gt. Brit. 189
radiant 264
radiant, installation in workshops 228
snow melting water heater 264
space 264
space, Reznor Nesbitt, Gt. Brit. 146
steam injection, cavitating effect control in 232
switch, LP-gas, remote control 330
Water, car wash 30
water, oil market 427
water, positive temperature control 30
water, use in kidney disease 190

HEATING

Blue Star Home program, Honolulu Gas Co., Hawaii 312
building energy requirements 456
business center, Occidental Center, Los Angeles 410
central heat-cooling system from public utility 264
central heating control, thermistor use 148
central heating and cooling plant, NASA, Nassau Bay, Tex. 112, 190, 292, 295, 329
central plant, steam, Allegheny Center, Pittsburgh, Pa. 292
central plant, water, Reston, Va. 367
church, LP-gas fired, St. Louis, Mo. 224, 331
classes, mfg. co. 387
computer control of in building 372
department store, Gt. Brit. 146
electric, condominum, Sea Bright, N.J. 309
electric, conversion to, statistics 275
electric, economics 314
electric, eye clinic, Fergus Falls, Minn, 316
electric, high school, Ludlow 310
electric, high school, Toledo, Ohio 310
electric, nonresidential market 241
electric, office bldg., John Hancock Center, Chicago 343
electric, office bldg., Kane, Pa. 316
electric heating, home, increased use, statistics 7
electric infrared, installations 385
electric, infrared, school, operating cost 7
electric *vs.* gas, hospital 343
electric *vs.* gas, multiroom bldgs 310
electric *vs.* gas, school, Shingle Creek, Minn. 205, 427
by electron bombardment 51
evaluation of new and different ways to heat the home 295
gas, statistics 345
gas, systems 370
gas-fired hydronic boiler, home, Md. 370
heating, intake air 28
high schools, climate and nonclimate controlled comparison 455
homes, sales, Gt. Brit. 429
hotel, Washington Hilton 410
householeating customer, 1964 312
humidification needs 368
infrared, apparatus 265
infrared units, food warehouse 370
by light, total electric bldg., West Long Branch, N. Y. 45
by light, high school, Kimberly, Wis. 56
by LP-gas in construction work 190
by LP-gas in Northwest, U.S. 144
municiple heating systems, piping 299
oil, apartments, Riverview Towers, Paterson, N.J. 275
oil, projects, costs 275
Piccadilly Plaza, Manchester, Gt. Brit. 146
piping, labor estimating, component method 367
by plasma, progress review 395
by propane, Essex, Gt. Brit. 112
quality of environment in heated spaces, method of rating 295
salt mine, ventilating air 330
solar-gas absorption cooling, heating system, mathematical model of 293
system, life insurance complex, Los Angeles 367, 368
systems, comparative cost analysis 386
town, gas fired warm air central system, Cumberland, Scotland 73

HEAVY WATER

produced by NH_3 -H_2 exchange, Western Deuterium process 183
production from natural gas, Canadian process 289

HELIUM

analyzer, portable 83
apparatus, concentrating trace impurities in 379
capacity level gauge 33
ionization cross section 382
liquid, storage vessels for 137
recovery, natural gas 285
recovery, cryogenic process 254
recovery, natural gas, fluorocarbon membranes 133
recovery, natural gas, plant, Kansas 206
recovery, natural gas, by permeation 96

HEXANE

adsorption from a solution in benzene 201
-methane-nitrogen system, vapor-liquid equilibrium 467

HIGH PRESSURE

alkanes, mass spectrometric, high pressure 38
control of 372
droplet vaporization, in gas stream 14
super pressure tubing 32

HIGH TEMPERATURE

droplet vaporization, in gas stream 14
alkylaromatic, hydrogen exchange with deuterium oxide 340

HYDROCARBONS

aliphatic, binary mixtures, critical temperatures, and pressures 425
alternant molecules, propagators for 340
amount produced during controlled combustion 369
aromatic, manufacture of 103
aromatics from ethylene by-product light oil, Japan 404
bray jets, hydrocarbon-rich gases 29
CO_2 removal 133

CO solubility in at cryogenic temperatures 43
concentration measurement, ppb 200
content in gas, measurement of 200
electrochemical oxidation of 159
excitation by low energy electron beams 87
formation in electrolytic reduction of acetone 183
fuel gas, liquid hydrocarbons, gasification 24
gas chromatographic method for simultaneous analysis of mixture of fixed gases and 303
gasification to H_2 and CO 103
heavy liquid, hydrocracking to aromatics and fuel gases 449
hydrocarbon adsorption, galvanostatic, volumetric studies, fuel cell 8
hydrocarbons, combustible gas, apparatus 25
hydrocarbons, production, Cambrian rocks, wellhead prices 11
hydrogen from, process 363
hydrogen enriched hydrocarbonaceous products from coal 363
hydrogenation, dripolene from 183
injection in blast furnace, kinetics of 202
light, viscosity of 426
low-temperature steam reforming of 53
methane-free aliphatic multicomponent mixtures, interaction model for critical temperatures of 469
methane-free binary mixtures, vapor-liquid equilibrium constants, correlationship 423
methane solubility in at cryogenic temperatures 43
mixtures, thermodynamics of 86
nitrogen solubility in at cryogenic temperatures 43
olefins from pryolysis of gasoline, Lurgi Arosolvan process 405
physical properties 306, 340
polymerization, growth of carbon articles produced electric discharge 379
polynuclear, emissions from industrial processes 293
properties correlations with composition 468
pyrolysis by stable high temperature flames 222
radiolysis, energy transfer 203
radiolysis, model for radical reactions in 238
radiolysis, mechanism 238
removal from natural gas, adsorption process 58
separation of paraffins from mixtures of, methods 326
solutions, activity coefficients 160
trace analysis in natural gas 119
transition-metal catalysts, π-bonded intermediates, hydrocarbon reactions 22
unsaturated, single and triplet transitions, ultraviolet spectra 237
volatile gases, solubility in at cryogenic temperatures 43

HYDROCRACKING

catalyst developments 206
ceramic fiber pipe insulation, hydrocracker 463
construction, plant census 449
equipment design 268
gas oils, variables affecting gasoline, furnace oil 183
gasoline from coal, prototype unit 363
H-G process 290
heavy liquid hydrocarbons to aromatics and fuel gases 449
hydrogen production for 222
Isomax process, applications 257, 290
processes 450
reactor, Gulf Oil Corp.'s Port Arthur refinery, Tex.
role of metal on hydrocracking catalyst 220
tungsten catalysts role 325
Unicracking-JHC unit 221
use by Calif. refiners, economics 257

HYDROGEN

attack on steel, curves predict steel life 233
chemisorption detector 84
corrosion by, plants 269
determination by gas chromatography 304
determination in steel by manometer 150
effect on hydrocarbon equilibrium ratios 202
embrittlement of steel 301
flame ionization detector 226, 227
formation in radiolysis of propane, effect of electron scavengers on 383
heat recovery, methane, steam-reforming, H_2 production 7
from hydrocarbon gas and steam, process 290
from hydrocarbonaceous gases, electrolytic process 258
from hydrocarbons, process 363
hydrogen liquid evaporation 19
ionization cross section 382
manufacture of for ammonia synthesis, by practical oxidation of methane 64
manufacture of UOP process 450
-methane reactions, kinetics, carburization and decarbudization of 382
plant corrosion control 232
production, low-temperature steam reforming of hydrocarbons 53
production integrated with refinery operations 222
purification, Pd-diffusion, UCC's Linde Process 104
purification of 43, 52
recovery, cryogenics use 133
recovery by palladium diffusion 183
recovery units, Pd diffusion, Union Carbide 172
solar reflectors, storage vessels, cryogenics propellants in space 19
synthesis gas manufacture 64
tank pressurization during liquified gas outflow 63

HYDROGEN SULFIDE

analysis in natural gas by methylene blue colorimetric test 156
determination in air, method 304
drying, molecular sieves filtering 24
Sulfinol process, evaluation, acid-removal operations 14
treatment, Panacide process, gasholders, Gt. Brit. 399

Removal

absorption by sodium arsenite, Giammarco-Vetrosoke unit, Milan gasworks 134
from gases 24, 285
from hydrocarbon with phthalocyarine catalyst 355
from hydrocarbon fuel gases 355
from natural gas, process 24, 439
sour gas, monoethanolamine degration prevention 173
Sulfinol process 14, 171
treating gas mixtures with K_2CO_3 solutions, steel corrosion inhibition method 285

HYDROGENATION

acetylene on Pt 219
butylene 184
CO on Fe and Ni catalysts, thermal effects 325
catalytic, study by molecular models 183
catalysts, zinc stearate 65
catalytic vapor-phase of oils from coal and oil shale 67
coal chars, high temps. and pressures, methane production 104, 105
coal-oils to fuels for supersonic aircraft 364
electrical conductivity, zinc oxides, ethylene hydrogenation 22
ethylene on Ni and Ni alloys 220
ethylene on Ni, influence of catalyst particle size 363
H-oil process, coal to fuel oil and gasoline 104
hydrocarbons, dripolene from 183
light petroleum distillate to town gas on Ni catalyst 364
petroleum fractions, catalyst study 219
transition-metal catalysts, π bonded intermediates, hydrocarbon reactions 22

HYDROGENOLYSIS

catalytic, ethane to methane on silica-supported metal catalysts 64

IMPORTS

gas, Indep. Petrol. Assoc. Am. urges moratorium on 346
gas from Netherlands to Belgium and West Germany 387
gas from Nigeria to Gt. Brit. 345
Iranian gas to Russia 434
LNG and LP-gas, Japan 313
oil, Argentina 164
oil from Libya to Gt. Brit. 206

INCINERATORS

commercial gas market 456
heat recovery from, use 265
home usage advantages, study 146
hospital 111
industrial installation 74
LP-gas fired, mobile 74

INDUSTRIAL GAS

drying, plant use, Gt. Brit. 112 (2)
rapid melting techniques, metals, progress, Gas Council, Gt. Brit. 457

INDUSTRIAL HEATING

burners used in application of vinyl plastic coating on steel 295
carburizing furnaces, infrared gas conrtol system 331
examples, North East Gas Board, Gt. Brit. 330

factory, pressurized ductless system 73
furnaces, powdered metal parts plant 75
gas-fired makeup air units, installation in foundry 295
generation of controlled atmospheres 296
infrared burners for glazed tile 265
kilns, earthenware manufacture 74
propane use in potato chip plant 75
radiant with circulating hot oil, gas-fired heater used 330
submerged combustion for water plants 296
by wood, plant 279
INFORMATION RETRIEVAL
automatic documentation 4
engineer use of information 430
technical information, network system 49
well data system, data processing, punch cards, tape 5
INSULATION
ceramic fiber, hydrocracker pipe 463
coated steel sheet for protection of pipeline thermal insulation 232
foam insulation, refrigerator use 35
gas decomposition plants, low temperatures 117
gas-filled porous solids 43
inorganic fiber fabrics 464
liquid gas tank 63
liquid H_2 fuel tanks 138
multilayer for cryogenic storage 322
perlite, thermal conductivity of at low temperatures 269
pipelines with polyurethane foam, Italy 401
polyurethane foam, heavy oil line 215
urethane foam 376
vapor barrier materials 82
INTERCHANGEABILITY
investigation, Gt. Brit. 339
synthetic gases with natural gas 294
ION REACTIONS
ion-molecule reactions in propane, mass spectra 42
rare gas ions and methane 202
IONIZATION
cross section of gases from threshold to 1000 ev 382
gases by laser beams, theory 159
ionizing waves of potential gradient 307
reversal temperatures determination in excited gas 307
ISOMERIZATION
butane 184
transition-metal catalysts, π-bonded intermediates, hydrocarbon reactions 22
ISOTOPES
large scale separation 34
methane, chromatographic separation, charcoal column 36

J

JOINTS
bell and spigot, externally sealing, keyhole technique 260
butt-welded, high speed strip annealing 109
clamped, for thin wall pipe savings 233
ductile iron 233
electroslag-welded, fatigue strength 464
molded pipe seal 119
o-ring gaskets aid in corrosion control 154
plastic sleeve 100
sealing in conduit systems, method 118

K

KILNS
earthenware manufacturer 74
for sanitary ware, West Midlands Gas Board 267
tile firm 457
tunnel, converted to gas, refractory plant 331
KINETICS
age distribution, open systems, 1963-mid 1964 41
heat conduction 41
heterogeneous, catalytic reactors 22
homogeneous stoichiometric chemical reactions 382
intermolecular potential energy function for pairs of simple polyatomic molecules 382
methane-hydrogen reactions, carburization and decarburization of y-Fe 382
reaction rate, temperature dependence, NO_2 decomposition 40
simulation design, stability and control 34
thermal transport coefficient, kinetic approach and the correlation function method 44

L

LASERS
chemical, U. of Calif., Berkeley 93
ionization of gases, theory 159
oil and gas exploration tool 169
photogeologic surveys use in 298
welding with 337
LEAKAGE
pipe leak, internal sealing method 117 (2)
LEAK DETECTION
by air, mains 453
by airborne infrared scanning systems 442
apparatus using soil samples 328
CO alarm 33
flame ionization detectors 143
gas analysis, high sensitivity detector 33
leak noise location device 117
methods 373
packer with TV camera 117
radioactive isotopes use 144, 373
ultrasonic detector 114, 229
LIGHTING
air conditioning with, office bldg., Can. 368
heating by, Electronics Ass. Inc., N. J. 45
heating by, high school, Wis. 56
room load, application to air conditioning 108
LIQUEFACTION
apparatus for gases within storage vessel 446
coal 65
methane, system 322
by multiple expansion refrigeration 361
natural gas, mobil pilot liquefier 255
natural gas, process 101, 288
process Conch Intern. Methane 348
LIQUEFIED GAS
energy derived from expansion of 348
gasifying while producing mechanical energy 348
sampling device 422
LIQUEFIED NATURAL GAS
evaporator units, Canvey Island 178
experimental research station, Gaz de France, Nantes 254
importation from Nigeria to Gt. Brit. 90
imports, Japan 313
investment and operating costs 288
liquefaction process 101, 322
methane terminal, Canvey Island 20
pipeline, transmission costs 101
processes and equipment, book A.G.A. 255
projects, U.S. 180, 323, 346, 403 (2)
shipping LNG from Middle East 126
structure, X-ray diffraction measurements 422
tanker, Jules Verne 179
tankers, Methane Princess and Methane Progress 324
LNG Plants
Brooklyn Union Gas, Brooklyn 447
Camel, Algeria 63, 288, 403
future, construction cost savings 386
Gaz de France, Nantes experimental station 254
mobile platform 63
Nigeria 254
Panhandle, Kansas 254
for peak shaving, economics of 361
San Diego Gas Electric 361
Tenn. Gas Tranmission, Hopkinston, Mass. 224
Tex East. Trans., Linden, N.J. 323
Wis. Nat. Gas Co., Oak Creek, Wis. 328
LNG Storage
concrete tank surrounded by earthfill, Tex. East. Trans. project, Linden, N.J. 323, 361, 447
frozen earth, costs 63, 288
frozen earth, Hackensack Meadows, N.J. 21, 180, 323
frozen earth, method 448
frozen earth, method, Conch Intern. Methane ltd. 21, 362
information book, A.G.A. 255
tanks 21, 101, 217, 361 (2)
tanks, Wis. Nat. Gas Co. project 178
tanks on tanker, Jules Verne 101, 179
tanks on tanker, Methane Princess and Methane Progress 324
trends, U.S. 138
LOGGING
charts for formation evaluation 170
chemical in bore hole strata 397
sonic and neutron, gas productive sands identification, Gulf Coast Gas 249, 398
well data system, data processing,

punched cards, tape 5
LP-GAS
air conditioning, church, St. Louis, Mo. 331
carburetion equipment and fuel for vehicular fleet, co. 370
carburetion system installed in Ford Motor vehicles 147
car thawing, coal-dock dumping 30
cavern storage 138
Coastal States Gas Producing Co. 13
construction work use 190
controlled atmosphere apple storage 329
crop drying 226
curing tobacco, fuel oil competition, farm engine use 147
flame cultivation 226
gas engines, dual fuel carburetion 72
generator, dual fuel carburetion 72
greenhouse, environment control 456
greenhouse use, tomatoes 189
heater used in radiant heating system of circulation hot oil 330
heating and frying, potato chip plant 75
incinerators, mobile 74
industrial drying processes, applications 331
irrigation system, power unit 147
lift trucks, conversion of LP-gas, savings 147
lift trucks, market expansion 31
motor vehicles use, Orlando, Fla. 190
odorizers, automation of 173
odorization 97
pipeline, Alleghenies, Pa. 17
pipeline, little big inch extension, gas in Northwest, costs 20
propane recovery from oil, absorber tests 134
safety clinics 391
snow-melting installation 370
storage and distribution terminal, Felixstowe, Gt. Brit. 179, 255
storage and handling, codes 137
storage in salt formations 181
storage, refrigerated economics of 20
storage, safety practices 254, 255
storage terminal, Immingham, Gt. Brit. 287
switch heaters, remote control 330
tanker, Paul Endacott, shipment 179
tanker, fire, Aylmer, Ontario 346
tankers and terminals, costs and experience 447
tanks, relocation 323
thermoelectric generator, costs 55
underground storage capacity 403
underground storage method 362
weed control, flaming cotton 29
weevil control, U.S. Dept. of Agri. research 329
Distribution
high pressure gas, domestic service 27
radio network 59
and use problems, East Europe 457
LP-GAS INDUSTRY
aggregate drying plant market 457
anhydrous ammonia market 313
Australia, domestic production, market research 20
camp market, yr-round 331
costs and markets, Japan 370
heating market, Northwest U.S. 144
imports, Japan 313
industrial market potential 390
investment sales, 3-yr tabulations 2
marketing trends 49
markets, Petrolane Gas Service 430
mobile home market 74
outdoor market 331
production, U.S.S.R. 58
propane commodity futures market 313
research projects 226
sales, markets, co. 390
sales program, co. 364
shipments, exports, consumption, census, 1963 13
LP-GAS INDUSTRY STATISTICS
appliances sales 277
househeating 345
markets and sales 277
sales and consumption, 1964 20, 49, 59, 127
LUBRICATION
gas bearings 28
gas bearings, dynamic behavior 190
oils, vapor pressure, measurement, 10^{-5} to 10^{-1} Torr. 37
plastic bearing, non-lubricated 459
process, material combinations 417

M

MAGNETOGASDYNAMICS
channel flow 123
Lorentz force calibrator for interaction coils 156
electric power from MHD equipment and solid propellant rocket 434
MAGNETOHYDRODYNAMICS
flow in rectangular ducts, analysis 237
fusion control, experimental methods 9
molten metal *vs.* plasma conducting fluids 9
wakes 86
Generators
generator 9. 53
combustion chamber for 434
electrode performance 9
fuels, merit of 167
open cycle 53
travelling wave, equations 245
travelling wave, performance 246
water-cooled insulating walls 316
MAGNETOPLASMADYNAMICS
nonequilibriums ionization in MPD power generation 246
MAINS
blanking off under pressure 328
coating maintenance, railroad crossing 176
connecting extensions to, method 365
corrosion control, test stations 81
ductile iron 233
extension, under frozen lake, Wis. 408
extension by plowing in method 70
gas-borne dust, experience, Gt. Brit. 224
gas flow in, different diameters in series and parallel 453
high pressure, diverted without interrupting supply 408
hydrostatic testing 409
lead detection by air 453
pipe squeezing and reopening techniques 261
plastics 261
plastics, plowing in 70, 177, 408
plowing in method 260
relocation of, Sydney, Australia 453
road and rail crossings, laying 409
MAINTENANCE
centrifugal compressor, surge prevention 15
instrumentation, education 33
plant, application of work study to 459
process instruments, methods and costs 373
sensors to detect secondary energy effects 334
service work shop, valves and meters, refinery 460
Turnkey electrical contracts, pipeline modernization 26
MASS SPECTROMETERS
cyclotron resonance approach 271
recording, photography, mass spectra 37
MASS SPECTROMETRY
ammonium ion, solvation of 305
analysis of DC 704 diffusion pump oil fragmentation 421
data display system 338
digital recording application to simultaneous collection 338
gas analysis by 379
in gas analysis apparatus 302
gas pipette use in calibration 155
piezoelectric vacuum vibrator as ion source 155
servo-amplifiers for ion current measurement 271
MASS TRANSFER
bibliography techniques for age distribution, open systems, 1963 — mid 1964 41
computer model for moving beds 86
design equation, to fluids 273
multiparticle systems 39
nonsteady two-phase flow 39
MATHEMATICAL METHODS
equations, axisymmetric distortion of cylindrical shells 340
flows carrying particles 42
gas fluidized beds, solid thermal properties 40
mechanistic model, effect of experimental investigation factors on its development 123
partition function, imperfect gas 38
thermal regenerator, simulations, computer 39
turbulence intensification, chemical heat release 37
turbulent flow, helically coiled tubes 40
MEMBRANE
permeable, gas separations with 23
permeation processes, review 134
MERCAPTANS
alkyl, oxidation to disulfides study, A.G.A. 251
conversion to disulfides, fixed bed reactors, Howe-Baker Mercapfining process 213, 251, 356
determination by gas chromatography 235

removal from acid gas, Sulfinol process 171
METALLURGY
automatic heat-treating, hardening operations 30
hydrocarbons use as fuels for furnaces 190
steel tempering 30
METALS
corrosion control, materials selection 35
extensible sheets for cryogenic use 360
gas-metal reactions, concepts 197
impact testing of Al alloys 217
for low temperature storage vessels 19, 217
low temperatures testing 19
molten metal *vs.* plasma conducting fluids 9
rapid melting techniques, progress, Gas Council, Gt. Brit. 457
steel resistance, methods review 35
use of titanium in chemical process equipment 233
METERS
automatic reading of, test results 26
automation, instant flow record 441
displacement, distribution use 70
effect of entrained liquids on gas measurements 193
electric, statistical sample testing 114
flow integrator 193
gas, new valve mechanism, design 78
gas displacement 374
gas meter setters cut hot change time by use of meter cart 187
installation procedure, Southern Countries Gas Co. 453
interruptible gas flow totalizer 186
limitations and applications 328
marking systems 267
measuring small gas volumes 151
orifice, fittings and tube design 335
orifice, two-phase flow system study 328
orifice flow 33
packaged stations, portable 144
positive displacement, high pressure measurement by 193
reconditioning of, shops, automatic processes in 261
remote reading 78
remote reading, state of the art 292
rotary positive displacement types 193
temperature compensated 230 (2)
turbine water, products terminal use 186
METHANE
acetylene from, process 140
adsorption isotherms on carbon black 120
bacterial oxidation 64
burners, aerated 71
correlation energy of 202
detector, high sensitivity 33
determination in air 303
deuterated, exchange of hydroxyl groups of alumina and silica-alumina catalysts with 469
deuterated, slow neutrons scattering by 41
-deuterium exchange over Pt-Rh alloys 339
drift velocities of low energy electrons in 384
effect on hydrocarbon equilibrium ratios 202
electrochemical oxidation of 159
entropy of fusion 200
equilibrium constant for CH_4-iodine reaction 382
excitation of by low energy electron beams 87
formation from hydrogenation of coal chars 104
heat of adsorption on carbon black 120
heat recovery, methane, steam-reforming, H_2 production 7
-hydrogen reactions, kinetics, carburization and decarburization of y-Fe 382
ionization cross section 382
iron ore reduction 67
isotopic separation 36
isotopic shift in proton magnetic resonance of 160
liquid, structure, X-ray diffraction measurements 422
liquid, vapor pressure 88
liquid and molar volumes 273
mass spectrometric studies, reactions of gaseous ions 341
as moderator coolant, thermodynamic properties of 204
-*n*-butane system, interfacial tension 340
-*n*-hexane-nitrogen system, vapor-liquid equilibrium 467
neutron cross section, spin correlation effect 238
-N_2 mixture, midgap breakdown, calculations, radiolysis 383
N_2 system equilibria 272
one-center expansion wave functions 307
partial oxidation of 64
photoionization efficiency curves 383
photolysis of, CH_4 -CD_4 mixtures 105
-propane mixtures, thermodynamic functions 204
-propane-silica gel system, retention volume, adsorption 303
pyrolysis in N_2 presence 383
radiolysis of, acetylene production 469
radiolysis of, CH_4 -CD_4 mixtures 105
reaction with rare gas ions 202
solubility of in liquid NH_3 at high pressures and liquid phase densities 469
two-dimensional second virial coefficients on graphite carbon 425
vibration-vibration energy exchange between CO and 383
vibrational relaxation time 307, 308
viscosity 426
viscosity, CH_4-CD_4 mixtures 239
-water systems, photolysis of 425
METHANOL
methanol, fuel cell, electrodes 9
methanol fuel cell, Shell 8
partial molal enthalpy, methanol, acetone, water component vaporization from 3 component system 38
plant, Houston 24
production growth 104
MOHOLE
site selection 96
turbocorer 57
MOLECULAR SIEVES
adsorption capacity 24
catalyst market 67
catalysts 258
composite carbon 184
dry natural gas feed, gas processing plant 172
drying, molecular sieves filtering 24
preparation from clay 258
preparation from kaolin 258
n-paraffins recovery by 222
sieve analysis to 5 microns 140

N

NAPHTHA
(see also CATALYTIC REFORMING-Light petroleum distillates)
production at refinery for feedstock for town gas production 259
NATURAL GAS
adsorption process, removal of water, propane, heavier hydrocarbons from 58
analysis of samples, U.S., 1963 119
gas, coal, oil, energy market, growth rate 1
natural gas, energy market, position, Western Europe 12
trace analysis of hydrocarbons 119
Sui gas, utilization, in Pakistan 12
NITROGEN
air separation plant cycle, Linde 258
-CH_4 mixture, midgap breakdown, calculations, radiolysis 383
determination in air 303
liquid, refrigerant 76
production by air separation plant cycle, Linde 184
removal, natural gas, methane recovery 14
sampling 119
trace analysis in petroleum, microcombustion technique 85
type analysis in petroleum 85
volatile gases in hydrocarbon, cryogenic temperatures 43
NITROGEN OXIDES
amount produced during controlled combustion 369
colorimetric reagent for NO_2 in air 399
detector, high sensitivity 33
ionization cross section 382
reaction rate, temperature dependence, NO_2 decomposition 40
separation by gas chromatography 304
NOISE CONTROL
exhaust silencer for boilers, onsite energy plant 230
NONDESTRUCTIVE TESTING
corrosion control use, economics of 197
evaluation of surface defects by 465
fatigue cracks, ultrasonic detection and measurement 422
on-stream inspection by radiography 459
porosity and density by air displacement 156
refrigerating equipment inspection 421
NORTH SEA
barge, construction, Ocean Prince 6
barge, construction, Ocean Prince,

description, costs 6
building for drilling bases 437
drilling concessions, world's oil industry, North Sea 12
drilling operations 390
drilling operations, costs 437
drilling platform, Endeavour 353, 396
drilling platform, Mobil 130
drilling platform, Ocean Prince 351
drilling platform, Orient Explorer 168
drilling platforms 57, 132, 353
drilling rigs status 319, 353
exploration activities 57
exploration techniques 210
gas discovery, French, Dutch Frigian island 47
gas discovery, Rotliegendes, Germany 10
gas in Dutch portion for export 162
geology of 437
hydrocarbon prospects 242, 318
licenses, Norway 352
licenses, West German portion 133
pipeline installation factors 358
pipeline laying in 215
submarine routes, natural gas pipeline from Holland to Gt. Brit. 320
United Kingdom's policy 210
winter, barge, Mr. Cap, on location 12

NUCLEAR POWER
atomic energy, peaceful uses, U.N. Conference, Geneva 7
desalination by, state, government, plans 9
fast breeder reactors 350
fuel, optimization, power plant 280
fuel, private ownership of 54
fuel costs, Oyster Creek 129
fuel handling, equipment, nuclear fuel 10
generator in offshore platform 350
plant for manufacture of heavy walled pressure vessels for nuclear power plants 434
power growth, world 246
power station, Hunterston, Scotland 53
power stations, design, Gt. Brit. 350
SNAP devices (Systems for Nuclear Auxiliary Power) electric power by 434
superheat, power cost reduction by 55
thermionic converter, nuclear heated 37
vs. petroleum 245

NUCLEAR REACTORS
boiling water, light type, plant, Japan 394
boiling water, recirculation system using jet pumps 435
Canada, CANDU-BLW, cheap power 246 (2)
Canada, Whiteshell, No. 1, testing of 435
containment design 316
fast breeder 350
fast breeder, development 280
future power systems, evaluation 280
gas-cooled, concept 209
gas-cooled, economic power from 393
gas turbine use 281
light-water, AEC subsidizing decision 94

O

ODORANTS
properties, table 143

ODORIZATION
liquid odorant feeder 356
LP-gas 97, 173
methods and equipment for determining odor level 59
natural gas 173
supplemental practices 292

OFFSHORE OPERATIONS
(see also EXPLORATION Offshore)
first commercial production of natural gas, Tex. 319
gas production, Gulf of Mexico 250
large scale deliveries, offshore gas field, Texas Eastern, Gulf Oil 12
Libya, drill test 131
packaged engine-compressors, installations 356
search activities 318
Spain, permits, Royal Dutch Shell 132
telemetry 170
world activity 250

OIL SHALE
development, U.S. Government 129
hydrogasification in continuous-flow reactor 221
oil from, Colony Develop Co 247, 313
oil from nuclear explosions 394
oil production, review 10
projects 316
pyrolysis by hot balls 105
pyrolysis of, method 105
Qusseir shales, mineralogical analysis 10
U.S. Government policy 209
U.S.S.R. industry 429

OLEFINS
oxides, from catalytic oxidation of ethylene 406
pyrolysis of gasoline, Lurgi Arosolvan process 405

OPERATIONS RESEARCH
computers, crude oil economic evaluations 91
fluidized bed 66
information networking technique 49
sealed bidding on undeveloped leases strategy 430
systems analysis 80

OPTIMIZATION
process, simplex self-directing evolutionary operation 299
theory, review 335

ORE REDUCTION
blast furnace method 87
furnace for reducing metal oxides 451
iron by methane, Purofer process 67
iron ore, fluid bed reactor 68
iron ore, fluidized bed, apparatus 67
iron ore, process 104, 327, 451
iron ore, process, rotating cylindrical furnaces 377
iron oxides, process 451
reduction rate of porous pellets of iron ore with hydrogen 326

OVENS
gas-fired, infrared use for fluid-bed coating 194
gas-fired, vinyl plastic, costs reduction 31
infrared, painting and coating 112
for tube drying 112
in zipper plant 329

OXIDATION
carbon and graphite, kinetics 340
catalytic, ammonia on Pt-Rh 305
electrochemical, hydrocarbons 159
hydrocarbon adsorption, galvanostatic, volumetric studies, fuel cell 8
nuclear graphite, effect of gas transport in limiting rate of 123
olefins, rate of methylene blue photosensitized 341
propane by ozone 68

OXYGEN
-acetylene reaction 42
ionization cross section 382
solar reflectors, storage vessels, cryogenic propellants in space 19

OZONE
propane oxidation 68

P

PARTICLE SIZE
spectrometer, atmospheric particle size analysis 236

PATENTS
examiners, judges, qualifications, duties 5
U.S. Government policy 277

PEAK LOAD
gas output fluctuations, study, France 306
peak-day delivery capacity increase, gas co. 107
plant, packaged gas turbines 98

PEAK SHAVING
demand-commodity rate, price, natural gas 99
LNG facilities, projects, U.S. 403
LNG plant, economics of 361
LNG plant, Tenn. Gas Transmission 224
LNG plant, Wis. Nat. Gas Co., Oak Creek, Wis. 328
propane-air mixtures, injectors for, France 142
propane-air plant, Bridgeport, N.Y. 453
propane-air plant, Iowa 409
propane-air plant, remote control of blending 261
propane plant, gas turbine compressor unit use 292
underground storage capacity, statistics 403

PENTANE
viscosity 239

PERSONNEL
equipment selection, personnel training 2
industrial psychologists 50
pension plans, Am. Chem. Soc. members 430
petroleum engineers, need 92
petroleum industry, engineers 91
practice, safety record, Shell 6
training programs in the gas industry 276

PETROCHEMICALS
acrylonitrile from propylene 140
Alberta, Can., growth 278
benzene production 129
Canada, Chemical Valley growth 347
capacity, activity, NH_3 plants listing, U.S., Can. 5
from crude oil 327
ethylene and acetylene, Wulff unit, Europe 206
expansion, Romania 311
feedstocks, advances in 347, 431
formaldehyde, domestic production 23
growth, France 91
growth, Puerto Rico 90, 390
hydrocarbons as feedstock 340
industry, process innovations 326
markets, company competition 164
plant, ANIC-Gela, Sicily, ENI facility 172
plant, Bombay 259
plant design, scale model, Union Carbide 431
plant simplification thru improved design 374
plant site report 5
plants, use of austenitic cast iron in 233
processing, new methods 105
production and expansion, U.S., abroad, accounts 5
production in Yugoslavia 90
production by radiation 53
refinery, Mobil Oil Francaise, Frontignan 68
trade-zone plan, Oil Imports Admin. 50
urea-ammonia nitrate 51
urea plants, large capacity 347
PETROLEUM
asphalts, analysis 421
coking, U.S. West Coast 167
exploration, Telluric currents, geological data 8
microbial growths on 394
origin, geologic evolution 13, 57
protein from, Lavera refinery, France 350, 395
PETROLEUM DEVELOPMENTS
Africa, Central and Southern 347
Africa, North, 1964 347
Australia, gas *vs.* oil, energy market competition 1
Canada, Alberta oil sand project 132
Columbia 283
Europe, 1964 347
Far East, 1964 347
Mexico, 1964 347
Middle East, 1964 347
oil field, East Wilmington Tidelands, Calif. 92
oil field, Fourth Baku, U.S.S.R. 90
Pacific, Southwest, 1964 347
South America, Caribbean, 1964 347
PETROLEUM INDUSTRY
coal *vs.* oil, electric power generation 1
consumption, U.S., 1964 forecast 128
gas, coal, oil, energy market, growth rate 1
petrochemicals, feedstocks for, growth 5
vs. nuclear energy 245
petroleum engineering profession 91
petroleum engineers, need 92
world developments 391
PETROLEUM INDUSTRY FINANCE
earnings, 1964 244
PETROLEUM PRODUCTION
Africa 161
exploration, drilling development, problems 8
reservoir permeability, determination 439
shale oil production 10
stabilization unit, Hassi Messaoud, SN Repal 205
steam generation, thermal recovery, brine 15
from tar sands 54
U.S., 1964 312
U.S. projection, U.S. Dept. Interior 95
world, 1964 429
world, 1965 389
PETROLEUM REFINING
crude capacity 222
gas recovery operation, simulation 172
processes, review 219
refineries, U.S., statistics 223
refinery, computer control 460, 461
refinery, optimum operation, computer use 5
reinforced plastic pipe use 464
use of austenitic cast iron in 233
PETROLEUM RESEARCH
in Europe 207
protein from, France 350, 395
U.S. government, expenditures 313
PETROLEUM RESERVES
Alaska leases cleared by government 166
Alberta, Canada 244, 281
Canada, 1964 126, 208
Chile, Magellan area 242
U.S., 1964 167
world 391, 395
world, offshore 435
PHOTOLYSIS
ethane, vacuum-ultraviolet 203
methane-CD_4 mixtures 105
methane-water systems 425
olefins, catalyzed isomerization 87
PILOT LIGHTS
pilot burner 75, 76
PILOT PLANTS
automating, concepts in 297
data gathering system 303
scale-up 302
PIPE
aluminum use in Nigerian natural gas line 135, 175
austenitic cast iron 233
buckling axially compressed circular cylindrical shells 359
buckling of rings subject to impulsive pressures 361
buckling stresses of axially compressed circular cylindrical shells 360
corrosion inspection techniques, developments in 466
cost reduction, pipe grading system 6
ductile cast iron 197, 233, 376
effect of high velocity fluid flow on static and dynamic characteristics of 321
filament wound of fiber glass-reinforced epoxy 298
fracture resistance in, research 321
hydrodynamics of joint transport of gas and liquid in 273
line-pipe, 80 ft long 33
low alloy steel for steam condensate 153
pipe mill 177
polyvinylchloride, extruded process 419
portable coating plant 231
for refrigerant recirculation 268
spiral welded, manufacture of 464
steel, electrical resistivity 82
steel, induction welded 322
steel, polyethylene coated, self-sealing 152
steel, seamless and welded 419
steel selection for line pipe 155, 198
X-65 pipe in pipeline, Tenn. Gas 358
X-100 line pipe tested by Columbia Gas 286
PIPELINE CONSTRUCTION
Ahwaz crude, to Tehran 17
Alton Field, pipeline construction 18
aluminum pipe, Nigerian natural gas line 135
Appalachian ranges 175
Argentina, Gas del Estado 48, 357
Ark. and La., gas system, X-52 and X-60 pipes 400
Arkoma pipeline, Arkansas Louisiana Gas Co. 60
Australia, Gidgealpa-Adelaide line 99
Australia, heavy oil line, X-52 pipes 215
Belgium, pipeline system, Groningen gas 99
bending stress determination 286
bridge, suspension 62
British Columbia, Fort Nelson, Westcoast Transmission Co. extension 17, 287
British Columbia, hot water heated gas line 135
Canada, gas gathering system, Edson field 388
Canada, projects 443
Canada-U.S. pipeline 357
channel crossing, Scheldt, Belgium 401
Columbia, jungle area 26
cost accounting 428
crude oil pipeline, Service Pipe Line Co. 358
Des Plaines line, Northern Illinois Gas 286
Europe, big inch pipelaying record 215
Fla. Everglades, Humble's Sunniland field to Port Everglades 443
Greensboro to Roanoke, Va., Plantation Pipe Line Co. 253
Gt. Brit., East Midland pipeline 287
Gt. Brit., propane pipeline 175
hydrostatic testing 322
hydrostatic testing in winter 322
improvements in execution and control of welds, Gaz de France 377
India, Chhatak gas pipeline 175
Iran to Astara, U.S.S.R. 434

Italy, Apennines Mountains pipeline 215
Italy, Po Valley 401
Libya, Waha to Es Sider 358
LP-gas, Alleghenies, Pa. 17
mathematical model predicts 2 phase line performance 252
methods, trends, 1964 61
microwave-CO_2 welding, Tenn. Gas 443
mileage projection, 1965, U.S. 50, 62
mileage, world survey, 1965 444
municiple heating systems 299
Netherland Gasunie pipeline 286, 443
Netherlands, mainline 47
Netherlands, Rotterdam-The Hague line 252
Nigeria, aluminum use 175
North Sea, installation factors 358
North Sea, pipeline laying 215
odd-angle elbows, making 420
photogrammetry use in surveying 358
pipe formed and welded on site, Central European Pipeline System 136
pipe-laying system, Yates-Badger 408
pipeline, 42-in., N.J., Transco 61
products pipeline, Wash. 215
relaying, stopping technique 99
relocation, Park Ridge, Ill. 408
river crossing, Georgia 136
river crossing, HSP method 400
river crossings, P.V.C. pipe conduit for 261
San Bernardino County, Calif. 444
submarine routes, natural gas pipeline from Holland to Gt. Brit. 320
survey, experience proven ideas of pipeliners 357
suspension bridge, A-frame 99
Tenn. Gas program, X-65 pipe 358
Texas and Fla., interstate system 49
on traffic bridges, pipeline design 100
Transalpine pipeline 48, 287, 357
Trans-Canada proposed pipeline 62
Trans-Canada western system planning 61
Turkish Oil Fields to Mediterranean 26
underwater, hot tapping technique 100
underwater, installation method 253
underwater tap equipment, cost and time savings, Tennessee Gas 16
Union Gas Co. of Canada, Ltd. 444
U.S.S.R., Bukhara-Urals pipeline 135
U.S.S.R., gas reserves exploitation 401
U.S.S.R., projects 61, 444
U.S.S.R., Siberia Yakutsk project 175
West Germany, Gasversorgung Nordrhein line 99
Western Europe, projects 444
X-100 line pipe tested by Columbia Gas 286
X-100 pipeline installation, Columbia Gas System Serv. Corp. 252

Costs

Canada, 1965 estimates 50
Europe 443
installation and equipment, 1960-1964 321
U.S., 1960-64 FPC report 216, 253, 286
U.S., 1965 estimates 50

Equipment

earthmoving auger 61
hydraulic ripper 175
lightweight steel piling use 358
robot rig 193
tractor-mounted welding unit 175

Offshore

Buccaneer field to Freeport, Tex. 357
CO_2 welding 443
Gulf of Mexico, Tenn. Gas Transmission 252
La., projects before FPC 61
Tex., Blue Dolphin pipeline, Buccaneer area, Shell 442

PIPELINE DESIGN

factors for hypothetical gas line 357, 443
flow computation manual for 252
mathematical model predicts 2 phase line performance 252

PIPELINE MAINTENANCE

coatings, mains, railroad crossing 176
corona breakdown as factor in jeeping coatings 358
efficiency increase after on-stream pigging 402
efficiency testing 253
extraction method of relaying service pipes 365
flood damage, repair, Calif. 401
flow behavior analysis, method 321
hydrostatic testing 322, 409
line stopping equipment 417
purging, low pressure 253
reconditioning of 359
submarine crossing 176
survey, experience proven ideas of pipeliners 357
Turnkey electrical contracts, pipeline modernization 26
underwater pipelining, manufacturers, Light & Heat Co., Ohio River crossing 107

PIPELINE OPERATIONS

computer program, pipeline network 359
control center 359
design considerations for crude, high pour point 176
gas line, Great Lakes area 17
investment evaluation, projects 359
little big inch extension, gas in Northwest, costs 20
offshore mooring, supertankers 25
plantation pipeline system 216
replacing a gas line, steel plant 176
two-phase flow, gas gathering system 25
Zaraitaine-Mediterranean pipeline system, North Africa 216

PIPELINE SYSTEMS

Argentina, Pico Truncado-Buenos Aires Gas del Estado 46, 48, 357
Arkoma pipeline 60
atlas, U.S. and Canada 401
Australia, feasibility, Gidgealpa gas field 169
British Columbia gas lines planned 321
Budapest, natural gas from Eastern Hungary 177
Canada-U.S. pipeline, Canadian gas to U.S. markets, Trans Canada-American Natural Gas agreement 357
control choice factors, pneumatics or electronics 458
control of high pressure 372
corrosion by sour gas 98
crude-condensate, transmission system 18
crude oil and products, future growth 359
energy services to food industry, ammonia 392
gas dispatch control, automation potential 400
gas line used for water transport 78
interface zone detection, fluorescent dye 445
Killingholme, East Midlands Gas Board, Gt. Brit. 321
Libya, Waha to Es Sider 358
line pipe trends 100
Los Angeles, gas pipeline serves oil field in 260
Louisiana-Florida, South La. gas price trimmed 136
municiple heating system 299
North Wales, automatic and remote control, high pressure pipeline 402
offshore, linking platform, La. 353
Pakistan, Multan to Lyallpur 389
Petroleos Mexicanos, microwave system 286, 356
pipeline, N.J. Transco planning, 42-in. pipe 61
products, interface detector 379
products pipeline terminal, power distribution and instrumentation 286
pressure regulators 366
propane, Felixstowe to Norwich 187
regulators, selection of 366
research, people and materials transport 51
static inverters, design and applications 359
steel, electrical resistivity 82
survey, experience proven ideas of pipeliners 357
U.S.S.R., gas main system, North Causasus-Moscow-Leningrad 135
U.S.S.R., gas reserves exploitation 401
world pipeline facilities 48

PIPELINES

capsule pipelining 224
capsule research, Can. 244
design for hydrocarbons 358
gas flow in resin coated 445
human engineering use in control of 176
industry acceptance of automation 174
projects, investment 387
slurry 347
solids transport 347
strength of thin-walled cylinders to dynamic internal pressure 159
temperature, effect of sun on, charts 445
transient gas flow 60
transporting solid and viscous material, method 223

PIPING
casing and tubing prices 62
glass 417
high pressure gas, domestic service 27
house system, 2 psig 291
labor estimating, component method, air conditioning, heating systems 367
large diameter, production mill 62
line-pipe, 80 ft long 33
plastic coated steel, X-Trube, Alabama Gas Corp. 78
reciprocating-compressor, computer analysis of pulse vibrations in 400
sizing equations 298
super pressure tubing 32
use of ASA Code, pressure piping, Sect. 3 460
PLASMA
fluidized bed feasible for reacting solids, commercial scale 42
fusion control, experimental methods 9
gun 33
parameters, E and B Fields, in coaxial accelerator 37
heating, progress review 395
seeded, gas phase and surface phenomena in 87
PLASTIC PIPE
advantages, distribution system 261
aerial gas distribution system, use in 186
asbestos reinforced 366
asbestos-reinforced, corrosion resistance of 464
coated steel tubing, X-Trube, Alabama Gas Corp. 78
conduit for river crossings, PVC, Glaslyn River, Gt. Brit. 261
corrosion by town gas 196 (2)
distribution system use, Calif. Pacific Util. Co. 259
distribution systems, cost comparison, plastic *vs.* steel, Milwaukee Gas Light Co. 260
high molecular weight polyethylene, Drisco-pipe 7000 uses 302
mains, plowing in 70, 177, 408
manufacturers, directory 268, 299
properties and uses 268
reinforced, petroleum refining use 464
use in Netherlands gas industry 136
uses, statistics 224
PLASTICS
appliance use 302
aromatic polymers 153
bearings, non-lubricated 459
coated drill pipe, corrosion costs reduction 419
construction use in housing 153
corrosion control by 116, 269
curing agent 118
gas-fired ovens, vinyl plastic, costs reduction 31
insulation of underground steel pipes 269
panels in refrigerated warehouse construction 420
polyester resins, classes 419
polyethylene, vulcanizable 68
polyphene oxide 82
reinforced, ablation of, analysis 159
reinforced, corrosion control by 116
reinforced, new products 118
research and development in 337
Synvarac, properties 118, 269
thermoplastic polysulfone 234 (2)
vinyl manufacturers, competition 377
POLYMERIZATION
ethylene on CrO catalysts 220
ethylene on tert-butylperoxy isopropyl carbonate 22
hydrocarbons, growth of carbon particles produced electrical discharge 379
ionic of ethylene, mass-spectrometric study 124
p-xylene to di-p-xylylene, coating 105
zeolites, catalyst markets 23
POLYMERS
linear high polymers, specific heat 39
polyethylene, vulcanizable 68
statistical, polymer solutions, second virial coefficient 43
for temperatures up to 13,000°C 154
POROSITY
analytical model 36
gas-filled porous solids 43
PRESSURE REGULATION
high pressure, domestic use 27 (2)
line stopping equipment 417
regulators, applications 366 (2), 409
regulators, design 409 (2)
regulators, selection of 366 (2)
PRESSURE VESSELS
high temperature creep test 322
stainless steel weld cladding for 155
PROCESS CONTROL
computer, Canadian chemical processing industries 461
computer applications 335
computer installations, survey 460
direct digital control type, Canadian industry use 460
electronic analog and hybrid computation, HPI use 460
failure of automatic systems 299
instrument developments 271
instrumentation, developments 334
low cost instrumentation 335
makeup air 28
sensors 271
switch controls between automatic and manual, Syncro control 335
trends 268
PROCESS DESIGN
computer use in catalyst specifications 268
critical path planning 374
heat recovery equipment, design and installation 418
materials selection 154
microwave radiation use 418
plant simplification 374
secondary air supply 28
scale-up from idea to plant 302
simulation design, stability and control 34
PROMOTION
all-gas apartment 314
appliance in TV programs 431
Blue Star Home program, Honolulu Gas Co., Hawaii 312
central air conditioning, standard equipment for homes 391
central heating, Ireland, Gt. Brit. 314
circus-type show, gas co. 348
design contest for gas home of the future, architecture students, Australia 431
electric air conditioning, homes 391
gas industry advertising slogan 314
gas ranges, features 431
total energy, Group to Advance Total Energy 431
PROPANE
-air mixtures, injectors for, France 142
-benzene system, enthalpy, isothermal pressure effect on 380
carburetion on concrete carriers, longer engine life 414
district supply Essex, Gt. Brit. 112
emergency services, co. 187
exploration tool, propane-based gas explorer technique 318
mass spectrometric study, high pressure 38
mass spectrometric study, ion molecule reactions in 42
mass spectrum, secondary ions in 123
-methane mixtures, thermodynamic functions 204
milk drying 414
oxidation initiated by ozone 68
peak shaving plant, Bridgeport, N.Y. 453
peak shaving plant, gas turbine compressor unit use 292
peak shaving plant, Iowa 409
peak shaving plant, remote control of blending propane-air 261
pipeline, Felixstowe to Norwich 187
radiolysis of 203
radiolysis, effect of electron scavengers on H_2 formation 383
recovery from oil, absorber tests 134
sea-thermal power plant 93
storage, frozen earth, cost, Wood Cross refinery, Phillips Petrol. Co. 63
storage, refrigerated, costs 45
storage terminal, Felixstowe, Gt. Brit. 218, 323
storage trends, U.S. 138
total energy systems, Canada 314
vaporizer system, brick plant 336
viscosity 426
PROPYLENE
acrylonitrile from, process 140
cryogenic recovery from gas streams 14
excitation of by low energy electron beams 87
PUMPS
canned, for slurries 115
in chemical plants, maintenance costs 299
cryogenic, high pressure 335
cryogenic, industrial 137
flat-plate helical inducer, cavitation studies 34
hydraulic program design, drilling rig 194
process, plant proven tips 335
process, selection 299
seals 79
selection and installation 268

turbo without a shaft 336
vacuum, cryogenic 360
PYROLYSIS
ethane, kinetics 380
gasoline, Lurgi Arosolvan process 405
hydrocarbons, combustible gas, apparatus 25
hydrocarbons by stable high temperature flame 222
methane in N_2 presence 383
oil shale by hot balls 105
solid carbonaceous materials 105
PYROMETRY
infrared monochromatic radiation technique, shock tube gas temperature measurements by 384

Q

QUANTUM MECHANICS
effects on transport cross sections 124

R

RADIATION
characteristics of light flash produced upon impact of liquid with surface 425
microwave, for chemical processing 418
microwave, for remote sensing 10
use in chemicals production 53
water pollution, gamma rays, sedimentation 10
RADIOLYSIS
acetylene 204
ethane, additives effect 203
ethane, density effect 203
ethylene 160, 203
ethylene, identification of ionic intermediates and formation of excited species by use of electrostatic fields 469
hydrocarbons, energy transfer 203
hydrocarbons, mechanism 238
methane, acetylene production 469
methane-CD_4 mixtures 105
methanol vapor, effect of H atom and electron scavengers on 384
model for radical reactions in hydrocarbons 238
olefins, radical yields 69
propane 203
propane, effect of electron scavengers on H_2 formation 383
REACTION KINETICS
chemically reacting gas ,velocity distribution 423
translation energy effect on ion-molecule rates 123
REACTORS
chemical, theory 300
energy conversion, axial dispersion in helical tubes 34
simulation design, stability and control 34
REFORMING
(see also CATALYTIC REFORMING)
hydrocarbons, low-temperature 53
hydrocarbons for source of D_2 183
hydrocarbons to H_2 for NH_3 production, furnace, Kellogg process 404
natural gas, Purofer process 67
REFRIGERANTS
alcohol-salt mixtures evaluation 265
Freon-502 332
liquid ammonia-salt systems 308
liquid nitrogen, cold chamber 76
liquid nitrogen, uses 147
piping for recirculation of 268
REFRIGERATION
absorption, defrosting 113
absorption, Trane Co. 371 (2)
absorption system 262, 371
apparatus, Worthington Corp. 79
condenser sizing 371
cryogenic systems, closed-cycle 360
cycle rotary shaft work, representation by pressure-volume, and temperature entropy diagrams 470
engine driven compressors, status report 458
equipment, non-destructive inspecting techniques 421
foam insulation, refrigerator use 35
ice rinks 31
nitrogen-chilled cold chamber 76
refrigerator using helium 371
reverse cycle apparatus 70
Stirling engine 239
system design, items and accessories 332
thermoelectric 95
thermostat control 71
warehouse erection, plastic panel use 420
REGENERATORS
influence on thermal efficiency of open-hearth steelmaking 412
RESEARCH
(See also GAS RESEARCH, PETROLEUM RESEARCH)
furnace for projects using refractory metals and alloys 111
heat transfer, review, 1963 to March 1964 40
hybrid computer, advantages 32
meshing R&D and marketing, chemical industry 391
pipelines, people and materials 51
R&D, effect on U.S. economy 51
RESERVOIR ENGINEERING
(see also Cryogenic Storage, LNG Storage and Underground Storage)
lowhole condition, temperature surveys in stream-injection wells 37
fire front location, in-situ combustion 96
frozen earth, LNG, Hackensack Meadows, N.J. 21, 180, 323
ground reservoir, liquefied gases 21
reservoir pressures determination from conductivity log 353
well-to-fault distance 283

S

SAFETY
coal, stock-piling precautions 127
drill stem testing, H_2S control 278
explosibility of carbonaceous dusts 127
fire-proof ball values 418
fire protection, refinery 164
fire truck 278
gas burners, flame control 92
LP-gas safety clinics 391
LP-gas storage, practices 254, 255
natural gas processing plants 207
petroleum spirit storage 165
practice, safety record, Shell 6
spilled oil collecting barge, *Waterwisser*, The Netherlands 51
standardization, hoses for appliance connection 262
storage, petroleum products 92
SAMPLING
chemical, as data filter 34
for gas manufacturing processes 200
for N_2 and SO_2, National Air Sampling Network 119
improvement in gas sampling accuracy 338
liquefied gases, device 422
methods in ICI reforming process, plant 466
plastic bags for, evaluation for air pollution 422
valve for combustion gas 304
SEALS
adhesives for use at liquid H_2 temperatures 154
valves sealing system 195
SECONDARY RECOVERY
(see also WELL STIMULATION)
inert gas use, Bayon Des Glaise field, La. 171
in-situ combustion with water flooding 353
oil well scale formation in waterflood operations using ocean brines 354
predicted recovery by waterflooding, Clinton sand, Logan oilfield, Ohio 438
pressure maintenance by gas injection, Hilbig Field, Tex. 133
steam generation, thermal recovery, brine utilization, Midway-Sunset field 15
steam injection developments in Calif. 132
steam stimulation 171
waterflood, Seven Rivers Sand project, Tex. 398
water injection, Matzen field 354
water-injection projects, Tex. 132
well bore heat losses from steam 171
SEPARATION
gas, permeable membrane, GE 23
gas, Ranque-Hilsch Vortex Tube 36
isotopes, large scale separation 34
low temperature, ethylene 65
SHALE OIL
(see also OIL SHALE)
shale distillation process 106
SHOCK TUBE REACTIONS
acetylene-oxygen reaction 42
argon, anomalous shock velocity measurements 42
between D_2 and NH_3, mechanism 87
current speed magnetic annular tube 42
flows carrying particles 42
gas temperature measurements by infrared monochromatic radiation pyrometer 384
SHOCK WAVES
analysis in particle laden gas 87
nonequilibrium flow of dilute reacting gases 160
nonsteady two-phase flow 39
structure in gas with several relaxing internal energy modes 239

SIMULATION
alcohol distillation for improved performance 32
cracking furnaces, computer designed 29
gas processing plant 182
gas recovery operation, petroleum refining 172
hybrid computer, advantages 32
pipeline and compressor system 174
reactor design, stability and control 34
thermal regenerator, simulations, computer 39
SLURRIES
concentration changes, analysis 106
ore flotation, flotation column 153
SOLAR ENERGY
air conditioning 167
concentrator, Ni, calorimetric evaluation 395
conversion systems, heat transfer analysis of thermal energy storage 381
sea thermal power plant 93
solar concentrators, performance 54
solar-gas absorption cooling, heating system, mathematical model of 293
utilization of, U.S.S.R. 350
SOLUBILITY
thermodynamics, gas solubility, in mixed solvents 43
volatile gases in hydrocarbon, cryogenic temperatures 43
SPECTROSCOPY
analysis of atmospheric particle size, spectrometer for 236
infrared gas cell 235
X-ray, reference-fusion method for specimen preparation 422
STANDARDIZATION
metric system, Gt. Brit. 348
STEAM TURBINES
-generators, growth, 1945-64 294
STEEL
application of vinyl plastic coating on 295
austenitic stainless, corrosion resistance 337
coatings for structural steelwork 231
corrosion by water or salt solns., measurement of 421
dissimilar, welding of 420
distribution systems, plastic *vs.* steel 260
drilling platform specifications for 96
electrical resistivity 82
heat treated, no decarburization, furnace 73
high strength, pipeline welding 253
high-temperature applications, power plant 301
improved by hot strip mill controlled cooling 376
industry, developments 377
low-alloy for steam condensate pipe 153
low carbon stainless, process uses 82
manufacture, combined LD/Kaldo technique, converter 376
manufacture, open-hearth, influence of regenerator on thermal efficiency 412
manufacture, town gas use 376
melting by plasma flame 155
melting, vacuum processes in 337
piling, lightweight for pipelines 358
pipe, seamless and welded 419
plate, pre-construction primers application 154
pressure vessels, high temperature creep test 322
preventive maintenance 35
reformer tubes, oxidation of by butane-steam mixtures 196
resistance to atmospheric corrosion 117
resistance to hydrogen, curves predict steel life 233
Ruhstahl-Heraseus Degassing process 153
selection for line pipe, criteria 155, 198
stability to high temperature, investigation of 198
stainless, corrosion control by 116
stainless, tubing, condensers 416
stress corrosion of 82
structure, hydrogen embrittlement study 301
vessels for storing liquefied ethylene 137
STORAGE
(see also CRYOGENIC STORAGE, LIQUEFIED NATURAL GAS Storage, LP-GAS, TANKS and UNDERGROUND STORAGE)
capacity, statistics, 1964 255
gas industry needs for 402
LP-gas, codes 137
LP-gas statistics 59
petroleum products, safety aspects 92
petroleum spirit, safety aspects 165
propane, refrigerated, costs 45
SULFUR
compounds in air, analysis methods survey 465
demand *vs.* production 69
determination in low boiling petroleum distillates 85
determination in natural gas 156
effect of organic sulfur compounds on nickel catalysts 59
sulfur, content of petroleum distillates 320
sulfur production, recovery from petroleum 97
volatile content, in liquefied gas, determination by Lingen method 421
Removal
-acidic gases from gas mixtures, absorbent process 58
coal, lowering S content 107
from flue gas, processes, status 400
from fuels and flue gases, review 320
from gases 24, 356
from petroleum, H_2S reduction 97
from spent iron oxide mass by coke oven ammonia liquor 356
hydrotreating, catalytic cracking feed, Humble Oil 213
iron-sponge process, gas processing plant 440
single-stage apparatus 98
SULFUR DIOXIDE
air pollution by, concentrations downwind of tall chimneys, power station 410
air pollution by, effect of increased chimney height on ground level concentrations, power station 410
air pollution by, effect of land configuration on flue gases dispersion, power station 410
air pollution role, analytical tracer technique use 304
detector, high sensitivity for 33
sampling 119
Removal
from air 28
from air by electrostatic precipitator 145
from power plant flue gases, Reinluft process, catalytic oxidation process, alkalized-alumina process 400
SURFACE CHEMISTRY
attractive forces at interfaces 37

T

TANKERS
LP-gas experience and costs 447
LP-gas, *Paul Endacott*, shipment 179
offshore mooring, supertankers 25
storage, transportation 21
LNG
construction, *Methane Princess*, *Jules Verne* 218
future projects, cost savings 386
Jules Verne 179
maintenance 460
Methane Princess and *Methane Progress* 324
Pythagore 179
TANKS
coating of bottoms with fiber-glass reinforced polyester 152
costs 102
cryogenic 63, 361
fiberglass, filament wound 179
floating roof 180
insulation systems, liquid H_2 fuel 138
level indicator, pressure switches 114
lining 81
lining, reinforced glass 197
liquefied gas removal from 102
LP-gas, relocation 323
LP-gas storage tanks, safety program 19
nickel steel, cryogenic, French liquid methane project 101
plastic bearing pads for 255
precoating of 151
pressurization during outflow of liquefied gas 63
refrigerated storage, API standard 137
specification for refinery, chemical and gas processing plants, bulk storage terminals 256
submerged hexagon shaped, rest on ocean floor 255
vessel for liquefied gas 21
TAR SANDS
Athabasca, plant construction 247
centrifugal processing of 54
oil recovery process 54

TELEMETERING
Algerian pipeline 177
automatic meter reading, test results 26
design factors, compressor stations 357
Methane Grid control, Canvey Island 18
microwave system, Petroleos Mexicanos pipeline system 286
residential meters, remote readings 32
system, remote stations 214
talking unit 100
tank liquid level reading 177
Turnkey electrical contracts, pipeline modernization 26
THERMAL CONDUCTIVITY
gas-filled porous solids 43
gas fluidized beds, solid thermal properties 40
gas mixtures, formulas 204
microwaves, remote sensing 10
perlite 269
polyatomic and polar gases and gas mixtures 273
roughened surfaces 40
statistical, polymer solutions, second virial coefficient 43
THERMIONIC POWER GENERATION
converter, fossil-fueled 165
converter, nuclear heated 37
THERMODYNAMICS
activity coefficients, hydrocarbon solution 160
aliphatic hydrocarbon mixtures, critical temps. and press. 425
combined heat power cycles 296
concepts, Brayton-cycle power conversion systems 384
corresponding states, principle of, extension to gas properties 425
corresponding states, systematic deviations from 383
ethane-*n*-heptane system, critical temperatures and pressures 382
function, methane-propane mixtures 204
gas condensate flow 58
gas solubility in mixed solvents 43
hydrocarbon mixtures 86
lattice gas, occupation probabilities 43
linear high polymers, specific heat 39
nonequilibrium expanding flows, study 88
properties of moderator coolants 204
properties of aqueous alcohol solutions, heat of mixing 341
of steam reforming 406
THERMOELECTRICITY
cooling equipment, submarine 95
generator, propane fired, cost 55
generator, radioisotope-fueled 55
generator with heat transfer and thermal expansion adaptor 279
generators for cathodic protection 418
new scale for low temperatures, Natl. Bur. Stands. 339
TOTAL ELECTRIC SYSTEMS
eye clinic, Fergus Falls, Minn. 316
office bldg., John Hancock Center, Chicago 343
office bldg., Kane, Pa. 316
TOTAL ENERGY SYSTEMS
computor evaluation of potential TES 193
design of 192
electrical unit controls 372
feasibility study techniques 351
growth potential, oil and gas 168
heat recovery equipment, design and selection 247
heat recovery, gas turbines 31
heat recovery problem, concepts 414
LP-gas fueled farm 148
market potential, gas and oil 241, 386
packaged heat recovery units 76
packaged turbine generator set 191 (2)
promotion of 207
promotion, Group to Advance Total Energy 431
propane, market, Canada 314
selection criteria 168
usage survey 392
Gas
apartment complex, Mediterranean Towers, N.J. 265
apartment project, Kansas City 76, 191
apartments, Canyon Crest, Salt Lake City 373
applications 373
carpet manufacturer 74
commercial building, Ohio Valley Gas Co. 266
feasibility studies by computer 296, 334
gas engine utilization 77
gas turbines, operation and maintenance 374
gas turbines, operation and maintenance experience, Southern Calif. Gas Co., office, Downey 413
high school, Hillcrest, Canada 113
high school, McAllen, Tex. 414, 458
manufacturing plant, Amer. Meter Co., Fullerton, Calif. 167, 192, 266 (2), 332
manufacturing plant, Rockwell Mfg. Co., Ark. 32, 266
meter shop, Con-Gas Service Corp., Ohio 192 (2)
office, Southern Calif. Gas Co., Downey 351
office building, Elizabethtown, N.J. 188
show and office complex, Hood Corp. Idaho 191
showcase centers 76
tractor service center, Toronto, Canada 296
university, Oral Roberts, Tulsa, Okla. 266
Oil
market potential for 275
military power station, Gt. Brit. 414
service stations, Amer. Oil Co. 168, 191
TOWN GAS
(see also CATALYTIC REFORMING-Light Petroleum Distillate and GAS PLANTS)
bray jets, hydrocarbon-rich gases 29
combustion characteristics, control 259, 415
corrosion of plastic piping by 196 (2)
use in steel manufacture 376
Production
benzine conversion to 141
continuous reforming processes, development of 450
gasification process, Gt. Brit. 67, 139, 223, 364, 450
Humphreys and Glasgow 49
ICI process 66, 142
natural gas-air reforming plant, Hungary 184
plant specifications, hydrocarbon conversion 142
processes, principles 15, 140, 223, 256, 326, 407, 451
processes, review 15, 140 (2), 141, 142, 221, 256, 451
sampling procedures for processes 200
steam reforming, waste heat recovery economics 327
TRANSPORT PROPERTIES
application of Enskog relationships for prediction of 308
coefficients, correlation-function, density correction to shear viscosity 43
dense gases 274
high temperature expansion of thermal transport coefficient 308

U

UNDERGROUND STORAGE
(see also CRYOGENIC STORAGE, LIQUEFIED NATURAL GAS - Storage and LP-GAS)
abandoned Leyden coal mine, Denver 256
aquifer 138, 219
aquifers, hydraulic problems 138
capacity, statistics 255, 324, 403
cavern, needle's eye excavation, Cincinnati Gas Electric 447
frozen earth, costs 63
frozen earth, method 21, 362, 448
Gt. Brit., government bill, Gas Council 102
LP-gas, capacity 403
LP-gas, cavern 138
LP-gas, lined cavity 362
LP-gas in salt formations 181
natural gas in Gt. Brit. 180
natural gas, Los Angeles basin, Playa del Rey plant 181
new concepts, research, A.G.A. 448
reservoirs, France 403
thermally insulated roof for ground reservoir 218
trends, U.S. 138
West Germany 389

V

VALVES
Audco lubricated taper plug 230
ball, application 115
ball, design 115
ball, fire-proof 418
butterfly, cryogenic 287
check and fail-safe valve 375
for combustion gas sampling 304
compressor, defect detection 78
control for gas turbines 415
control of recirculation of catalyst in process system 231
corrosion of 270
cryogenic use 195
engineering trends 374

gate or rotary line, regulator use 372
HPI valving, trends 115
liquid-metal glass vacuum 151
moisture condensation problem 195
pressure regulating use 372
relief testing 272
safety-relief 151
sealants 79
sealing system 195
sizing control, liquid-gas mixtures 79
soft-seal block and bleed 79
types in chemical process industries 336
use of austenitic cast iron in 233
water, gas flow control, gas plant, Gt. Brit. 461
VAPOR PRESSURE
measurement, method, 10^{-5} to 10^{-1} Torr 37
methane, saturated liquid 88
VAPORIZATION
of droplet in gas stream 14
liquefied gas gasification while producing mechanical energy 348
three-phase flash, calculation 86
VENTILATION
salt mine, gas heated air 297, 330
VIRIAL COEFFICIENTS
hard core gas in two dimensions 88
non-polar gases, formulas 339
statistical, polymer solutions, second virial coefficient 43
VISCOSITY
argon-oxygen mixtures 239
coefficient, binary gas mixtures, approximation formula 342
correlation-function gases, shear viscosity 43
gas mixtures, formulas 204
gas treated as variable in computer program 426
light hydrocarbons 426
liquid or gas flow 60
methane-dueteromethane mixtures 239
multicomponent, nonpolar gaseous mixtures 341, 384
n-pentane 239
thermal transport coefficient, kinetic approach and the correlation-function method 44

W

WATER GAS
high peak process for carburetted water gas plants 185
Lurgi shift conversion plant, Gt. Brit. 290
WATER TREATMENT
ethylene plant 239
ion exchange process desalts brackish water 88
methods 411, 470
nuclear-desalting, state, government, plans 9
pollution, gamma radiation use, sedimentation rate 10
simplex high intensity cones for purification of refinery and chemical waste water 336
submerged combustion for waste chemicals 110
submerged combustion for water plants 296
WEATHER FORECASTING
advantages for gas industry 262
WELDING
Co_2, field results, savings 18
Co_2, pipeline construction 443
Co_2, pipelines, statistics 198
circular welding head, manufacture 83
dissimilar steels, process 420
electron beam 79
electron beam, penetration capacity 18
electroslag-welded joints, fatigue strength 464
failure, hot hydrogen service 83
fracture testing, apparatus 36
high strength pipeline steels 253
improvements in execution and control of welds, Gaz de France 377
induction method 322
laser 337
microwave-CO_2, pipeline, Tenn. Gas 443
nonvacuum electron beam technique development and progress 337
odd-angle elbows, making 420
on-site, pipeline construction, Central European pipeline system 136
pipeline, underwater 234
refrigerator condensers, wire fabricating of 198
socket-welded pipe 377
ultrasonic 100
WELL COMPLETION
(see also WELL PRACTICE)
companies share of drilling, statistics 248
gas well, Tex. 170
sour gas well 284
WELL PRACTICE
air injection wells 211
API rig-rating book 133
application of Russell's flow test method 439
attic oil recovery by inert gas 211
cement 284
electrolinking by impulse voltage in well bore cracks 95
mechanics of gas well perforating 319
produced water for reinjection on waterfloods 171
sour gas well completion 284
sour gas well perforating 284
subsea well converted to abovewater producer 211
temperature surveys in steam injection, well's down hole condition 87
tubing, inhibitor squeeze technique 81
well test analysis and methods 238
WELL PRODUCTIVITY
depletion-performance correlation for gas condensate reservoir fluids 284
flowing rates, big wells 319
gas, removal of waterlocks 354
mud removal agents 398
propping-agent spacer 439
test method, capacitance measuring device 96
wellhead performance curves 250
WELL STIMULATION
(see also SECONDARY RECOVERY
acid, ultra-deep wells 399
downhole air-gas burners 399
imbibition water flooding, Austin and Buda formations 398
pressure maintenance by bottom-water injection, San Andres dolomite reservoir 398
steam, injection, temperature surveys 87
steam injection systems, problems 439
treatment selection 284
well bore damage calculations 354
WELL TOOLS
(see also DRILLING)
barge, construction, Ocean Prince, description, cost 6
cement-lined tubing 320
drilling, cost reduction, equipment upgrading 2
heat treating, drilling equipment 30
jet sub for removing liquid heads from air/gas drilled holes 250
turbocorer 57
well service investment, Gulf Coast 133

Z

ZEOLITES
catalyst markets 23
ZINC
electrical conductivity, zinc oxides, ethylene hydrogenation 22

Service Available to *GAS ABSTRACTS* Readers

Xerox

Xerox copies of all articles abstracted in *Gas Abstracts*, except those enumerated, are available from the Institute at cost.*

1) Russian Articles.—Abstracts are obtained from services specializing in this field. English translations can be supplied by arrangement with the appropriate abstractor.
2) U.S. Patents.—Printed copies can be secured at 50 cents each (remittance with order) from the Commissioner of Patents, Washington 25, D.C.
3) Books, Special Reports.—When a price is given in the abstract, these should be secured from a bookdealer or the publisher; when stated free, from the publisher.

Cost of Service

The photocopy service charge is:

First 5 pages or fraction thereof of one article in one issue $1.50

Each subsequent 4 pages or fraction thereof of the above one article in the same issue....$1.00

Invoices are rendered to the Institute's Members and Contributors only; payment in advance is required of others.

The Institute may, at its option, fill orders from non-Members and non-Contributors without payment in advance, but an additional charge of $1.00 to cover billing costs will be made on each such order.

Microfilm

Microfilm copies of articles abstracted in *Gas Abstracts* are likewise available at cost.* The material is photographed on 35 mm unperforated negative film at 5¢ per page, with a minimum of 50 pages, $2.50, per order. Invoices are rendered to the Institute's Members and Contributors only; payment in advance is required of others. The Institute may, at its option, fill orders from non-Members and non-Contributors without payment in advance, but an additional charge of $1.00 to cover billing costs will be made on each such order.

Bibliographies and Literature Searches

The library staff will prepare literature searches which range from a listing of a few references to a comprehensive bibliography with abstracts. All inquiries are kept confidential and the inquirer should define his subject as precisely as possible. Cost quotation for searches will be given on request.

Back Numbers of Gas Abstracts

Single back numbers, volumes, or complete files of *Gas Abstracts* may be obtained starting with Vols. 1 (1945) and 2 (1946) at $35 per volume, unbound; Vols. 3 to date are available at current subscription prices, $25 per volume to U.S. addresses, $30 foreign. Monthly numbers are $3 each.

---

*In requesting and accepting Xerox or microfilm copies, applicant agrees to the following:

1. The applicant desires this duplication solely for use in lieu of loan or manual transcription. Responsibility for questions of copyright that might arise in this copying, and, in the use of copies, is assumed by the applicant.

2. The applicant understands that the Institute does not sell the photocopies, but merely performs the service of copying at the applicant's request; the fee paid is exclusively for such service and is established on the basis of no profit to the Institute.

3. The Institute reserves the right, at its own discretion, to decline to make photocopies requested, or to limit the number of copies, within the principle of fair use of copyrighted material.

List of Periodicals Abstracted

Acta Metallurgica
Actual Specifying Engineer
Advanced Energy Conversion
Air Conditioning, Heating and Refrigeration News
Air Conditioning, Heating and Ventilating
Air Engineering
American Ceramic Society Bulletin
American Gas Association Monthly
American Gas Association Laboratories Research Bulletin
Research Report
American Institute of Aeronautics and Astronautics Journal
American Institute of Chemical Engineers. Journal
American Society of Heating Refrigerating and Airconditioning Engineers Journal
Analytical Chemistry
Anti-Corrosion Methods and Materials
Appliance Manufacturer
Applied Mechanics Reviews
Australian Gas Journal
Australian Journal of Chemistry
Battelle Technical Review
Berichte der Bunsengesellschaft fur Physikalische Chemie
Brennstoff-Chemie
British Coal Utilisation Research Association Monthly Bulletin
British Coal Utilisation Research Association Quarterly Gazette
Bulletin of the American Association Petroleum Geologists
Business Week
Butane Propane News
California Oil World
Canadian Chemical Processing
Canadian Gas Journal
Canadian Journal of Chemical Engineering
Canadian Journal of Chemistry
Canadian Journal of Physics
Carbon
Ceramics
Chemical and Engineering News
Chemical and Process Engineering
Chemical Communications
Chemical Engineering
Chemical Engineering Progress
Chemical Processing
Chemical Reviews
Chemical Week
Chemistry & Industry (London)
Chemistry in Britain
Coal Research in C.S.I.R.O.
Coal
Combustion
Combustion & Flame
Communications of the Association for Computing Machinery
Compressed Air
Computers and Automation
Control Engineering
Corrosion
Cost Engineering
Cryogenic Engineering News
Cryogenic Technology
Cryogenics
Design News
Diesel and Gas Turbine Progress
Discussions of the Faraday Society
District Heating
Domestic Engineering
Drilling
Edison Electric Institute Bulletin
Electric Heat and Airconditioning
Electric Heating Journal
Electrical World
Electrochemical Technology
Electronics
Endeavour
Energy International
Engineers' Digest
Erdol und Kohle
Fire Journal
Fire Technology
Fortune
Fuel
Fuel Efficiency
Fueloil & Oil Heat
Gas
Gas (British)
Gas Age
Gas and Oil Power
Gas Appliance Merchandising
Gas Council Research Communication
Gas Industries
Gas Journal
Gas Service
Gas Turbine
Gas-und Wasserfach
Gas World and Gas & Coke and Gas Times
Gasovaya Promyshlennost
Harvard Business Review
Heating, Piping and Air Conditioning
Hydrocarbon Processing and Petroleum Refiner
I&EC Fundamentals
I&EC Process Design and Development
I&EC Product Research and Development
Instrument Society of America Transactions
Independent Petroleum Monthly
Indian Journal of Chemistry
Indian Journal of Technology
Industrial and Engineering Chemistry
Industrial Finishing
Industrial Gas
Industrial Heating
Industrial Research
Institute of Gas Technology Research Bulletins
Institute of Gas Technology Technical Reports
Inorganic Chemistry
Institution of Gas Engineers Journal
Instruments and Control Systems
International Chemical Engineering
International Journal of Heat and Mass Transfer
International Science and Technology
Journal of Accounting Research
Journal of the Air Pollution Control Association
Journal of the American Ceramic Society
Journal of the American Chemical Society
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of the Association for Computing Machinery
Journal of Basic Engineering
Journal of Business
Journal of Catalysis
Journal of Chemical and Engineering Data
Journal of Chemical Documentation
Journal of Chemical Education
Journal of Chemical Physics
Journal of the Chemical Society
Journal of Chromatography
Journal of Electroanalytical Chemistry
Journal of the Electrochemical Society
Journal of Engineering for Industry
Journal of Engineering for Power
Journal of Fluid Mechanics
Journal of Gas Chromatography
Journal of Geophysical Research
Journal of Heat Transfer
Journal des Industries du Gaz
Journal of the Institute of Fuel
Journal of the Institute of Petroleum
Journal of Materials
Journal of Metals
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical Chemistry
Journal of Property Management
Journal of Research of the National Bureau of Standards,
A. *Physics and Chemistry*
B. *Mathematics and Mathematical Physics*
C. *Engineering and Instrumentation*
Journal of Scientific Instruments
Khimiya i Tekhnologiya Topliva i Masel
LP-Gas
Lubrication
Lubrication Engineering
Materials Protection
Materials Research and Standards
Mathematics of Computation
Mechanical Engineering
Merchandising Week
Modern Industry & Machine Age
Modern Plastics
National Bureau of Standards Technical News Bulletin
National Petroleum News
NASA (National Aeronautics and Space Administration)
Contractor Report
Special Publication
Technical Memorandum
Technical Note
Technical Report
Technical Translation
New Scientist
Nuclear Science and Engineering
Nucleonics
Oil and Gas International
Oil and Gas Journal
Oil, Paint & Drug Reporter
Petro/Chem Engineer
Petroleum
Petroleum Engineer
Petroleum Management
Petroleum Press Service
Petroleum Times
Physica
Physical Review
Pipeline Engineer
Pipe Line Industry
Pipe Line News
Platinum Review
Power
Producers Monthly
Product Engineering
Progress (Pakistan)
Public Utilities Fortnightly
Radiation Research
Research/Development
Review of Scientific Instruments
Revue Generale du Gaz
Rivista dei Combustibili
Science
Science News Letter
Scientific American
Society of Petroleum Engineers Journal
Stroitel'stvo Truboprovodov
Svenska Gasverksforeningens Manadsblad
Technometrics
Transactions of the Faraday Society
U.S. Bureau of Mines Bulletin
Information Circular
Report of Investigations
U.S. Patent Office Official Gazette
World Oil
World Petroleum
Zhurnal Fizicheskoi Khimii